BERMUDA

IMPERIAL MYCOLOGICAL
15 JULY 1938
INSTITUTE

REPORT

of the

DEPARTMENT

of

AGRICULTURE

for the year

1937

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Board of Agriculture, 1937.

Hon. G. S. Patton, M.C.P., Chairman (till 25th March).
Mr. A. J. Gorham, Chairman (from 26th March).
Wor. B. C. C. Outerbridge, J.P., M.C.P., Deputy-Chairman.
Mr. E. J. Moniz
Mr. W. S. Cooper, M.C.P.
Mr. J. H. Hollis
Mr. H. T. North, M.C.P.
Mr. J. E. P. Vesey, M.C.P.
Mr. H. Dunkley, M.C.P.

Department of Agriculture, 1937.

Director of Agriculture, T. A. Russell, B.Sc., A.R.C.S., A.I.C.T.A., Dip. Agr. (Cantab).
Plant Pathologist, J. M. Waterston, B.Sc. (Edin.) A.I.C.T.A.
Agricultural Assistant, W. R. Evans.
Horticulturist, G. R. Groves (from 26th October).
Inspector of Produce, T. Arthur Hollis.
Clerk, Nora E. Hollis.

PART-TIME OFFICERS.

Government Veterinary Officer, C. J. Cooper, V.S.
Assistant Inspector of Produce, C. V. S. Early.
Sub-Inspectors of Produce, A. W. B. Fowle, T. J. Outerbridge.

LETTER OF TRANSMISSAL.

Agricultural Station,
Paget East, Bermuda
2nd May, 1938.

Sir,

I am directed by the Board of Agriculture to lay before His Excellency the Governor, for the information of the Legislature, the accompanying reports of the Department of Agriculture for the year ended 31st December, 1937.

I have the honour to be,

Sir,

Your obedient servant,

NORA E. HOLLIS,
Clerk, Board of Agriculture.

The Honourable,
The Colonial Secretary,
Hamilton.

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Report of the Director of Agriculture, 1937.

The Chairman,
Board of Agriculture.

I have the honour to submit reports of the Department of Agriculture for the year 1937.

1. AGRICULTURE IN 1937.

The year was one of unusual weather contrasts for it included the most extreme summer-drought experienced for very many years and also included some abnormally wet months which brought the annual rainfall well above the average. Figures of rainfall at the Agricultural Station (given in greater detail in Appendix A) show that, of 62.16 inches recorded during the year, July and August contributed only 2.48 inches while the three preceding months provided 23.76 inches. There was accordingly ample justification for the farmers' alternating complaints of too much rain and of not enough. As a measure of compensation there was an unusual scarcity of strong winds and, except for some destruction of the potato and tomato crops in April, little damage of consequence was caused by this means.

Shortage of suitable labour was another difficulty which most of the farmers had to meet. Owing largely to great activity in the building-trade, labourers were attracted in increased numbers to stone-cutting and constructional work where pay was higher or hours easier than on the farm. The difficulty was particularly acute on dairy-farms where work starts at a very early hour seven days in the week. A measure of assistance was given by the importation of from thirty to forty Portuguese labourers from the Azores, whose entry for three years was authorised by the Board of Immigration subject to their remaining on the farms.

The year started in an atmosphere of discouragement following the very poor returns from produce exported to Cananda in 1936. A reduced area was planted with vegetables for export and a number of fields reverted to grass and bushes. As a result the volume of produce shipped to Canada amounted to little more than half the corresponding volume in the previous year. Fortunately the prices obtained in the case of most of the vegetables

showed a significant improvement, so that the total value to Bermuda of the vegetable exports did not show such a great fall as was anticipated at the beginning of the year.

Thanks to a most successful tourist season the local demand for farm-produce was well maintained, and indeed, as usually happens, the demand in the summer months far exceeded the supply and large quantities of vegetables were imported. Greater efforts were made by growers to study the requirements of the local market and many found in it a profitable outlet for their produce. On the whole it is probably true to say that few farmers were in a worse plight and many found themselves in better circumstances at the close of the year than at its start.

The great decline in value of the export market and the increased importance of the local market, which have been a feature of recent years, have had the effect of altering the organisation of the industry. In former times when large volumes of produce were exported, shipment was made through a few licensed firms or individuals who not only were responsible for the marketing but also in many cases financed farmers and supplied seed and fertilisers, obtaining their return from the sales of the produce which passed through their hands. In present times a small proportion of the produce is exported and passes through the hands of the shipping-firms and most is sold locally by the growers themselves. Under these circumstances the shipper is not assured of any recompense and he is naturally unwilling, and in most cases unable, to make advances of money and supplies to assist farmers in the growing of produce which he may never see. The old system had its glaring defects, but it is now gone and nothing has taken its place. It is doubtful whether the industry can ever be fully prosperous until a workable system of organising production, regulating marketing, and possibly of financing growers has been devised and put into operation.

The need for improved facilities for the cold storage of agricultural produce is being increasingly realised. It is apparent that part of the importation of vegetables is caused by lack of continuity in the local supply. A buyer for a large hotel, for instance, cannot count on finding an adequate supply of cauliflower in the local market on any given day. In one week cauliflower may be plentiful to excess, in the next hardly to be obtained. Such irregularity of supply might be smoothed out to some extent if efficient and inexpensive cold storage were to hand. As regards the export market, it appears that, in the face of the most highly organized competition from other producing areas, shipment of celery and other perishable vegetables can only be successful and profitable with the aid of pre-cooling facilities, enabling the vegetables to be cooled promptly after reaping, to be transferred to refrigeration on the ship without re-heating, and so to arrive on the distant market in perfectly fresh condition. The provision of a suitable plant was fully considered and the advice of experts was sought in the persons of Dr. C. W. Wardlaw, Officer in Charge of the Low Temperature Research Station, and Mr. C. T. Watts, Refrigeration Engineer, Imperial College of Tropical Agriculture, Trinidad, who visited the Colony in April. Their report, written after thorough investigation of farming conditions and existing systems of handling and packing for shipment, stressed the necessity for pre-cooling if any export business in vegetables is to be maintained, and pointed out that such a plant to be effective must be situated on or near the dock. Specifications and plans of a suitable plant were included in their able and comprehensive report. In accordance

with these recommendations the Corporation of Hamilton was asked if a convenient site on the dock could be made available, but up to the end of the year the Corporation had not reached a decision. An appropriation of £18,000 for the construction of a cold-storage plant was passed by the Legislature in the Estimates of Expenditure for 1938.

The Export Markets. The quantities of vegetables and lily bulbs exported to various countries during the shipping season of 1937 are summarised in the following table. In the case of potatoes exported to the United States of America the figures refer to the shipping-season which started at the end of November 1936 and continued till April 1937.

Commodity.	U. K.	Canada.	Br. Guiana & B. W. I.	U. S. A.	Other Countries.	Total
Beets (bushels)	—	702	—	—	—	702
Cabbage "	—	2,720	1,178	—	—	3,898
Carrots "	—	10,965	142	—	—	11,107
Celery "	—	24,084	—	—	—	24,084
Cucumbers "	—	91	—	—	—	91
Kale "	—	—	—	4,728	—	4,728
Onions "	—	1,569	34	—	—	1,603
Parsley "	—	74	—	—	—	74
Potatoes "	1,293	4,789	246	9,691	—	16,019
Spinach "	—	149	—	—	—	149
Tomatoes "	—	9,464	—	—	—	9,464
Miscellaneous	—	40	—	—	—	40
Total (bushels)	1,293	54,647	1,600	14,419	—	71,959
Lily bulbs (cases)	386	175	—	1,742	43	2,346

The total volume of vegetable exports at 71,959 bushels compares with 126,019 bushels in 1936 and is the smallest volume exported from Bermuda in any year since records were kept. It represents 32% of the average quantity of vegetables exported in the previous ten years.

The estimated returns to Bermuda from the sale of agricultural produce (excluding cut-flowers) in various countries, arrived at by subtracting freight-charges and selling-costs from the gross receipts, are as follows:

Country of Export.	Estimated Value of Return.		
	1935.	1936.	1937.
Canada	£35,200	£17,100	£13,800
United States of America	8,900	11,400	8,900
United Kingdom	900	1,000	1,100
British West Indies & B. Guiana	600	200	400
Other Countries	100	100	100
	£45,700	£29,800	£24,300

The Canadian Market. As recorded in a previous report, the season of 1936, the first under the Canadian customs tariff founded on the Canada-United States Trade Agreement, was a disastrous one for vegetable-growers in Bermuda, the value of the Canadian market falling by one-half. It was not clear however whether the very low prices of that year were exceptional or whether they were to be regarded as a typical sample of prices which would prevail during the existence of the new tariff. The growers themselves, when the time came for planting again, showed their loss of confidence in the Canadian market by cutting the acreage planted to vegetables for export, and the volume of vegetables shipped to Canada in 1937 amounted only to 54,647 bushels as against 97,628 bushels in 1936 and 108,178 bushels in 1935, the season before the new tariff came into effect.

Fortunately the average selling-prices showed improvement over those of 1936 in the case of almost every major commodity. The calculated returns to Bermuda for produce sold in Canada in 1937 amounted to £13,800 which represents 81% of the corresponding figure for 1936 (£17,100) and 39% of the figure for 1935 (£35,200). Exceptionally high prices were obtained for carrots, largely as a result of severe frost-damage suffered by competing sources in the Southern States, and beets and potatoes also sold at a good price. It has to be borne in mind that the volume to which these prices refer was smaller than in previous seasons, and that, if larger shipments had been made, lower average prices might have been obtained.

In the following table the average price per crate at which each major commodity was sold is compared with corresponding prices in the four preceding seasons.

Commodity	1933	1934	1935	1936	1937
Beets, per crate	$1.57	$1.31	$1.72	$1.43	$1.84
Cabbage " "	1.73	1.92	2.33	1.50	1.85
Carrots " "	1.43	1.40	1.54	1.23	2.24
Celery " "	1.90	2.40	2.33	2.07	1.82
Onions " "	1.06	1.31	2.06	0.73	1.49
Potatoes " "	1.75	1.62	1.47	2.27	2.09
Tomatoes " "	1.61	1.90	1.60	1.16	1.32

If the cost of crate and charges for packing, ocean-freight, any land-freight, and brokers' commission are subtracted, it is possible to obtain some idea of the return to the farmer for produce selling at the prices quoted above in the column for 1937.

Commodity.	Calculated Return to Farmer 1937.
Beets, per crate	4/8d.
Cabbage, " "	2/11½
Carrots, " "	6/4½
Celery, " "	3/2½
Onions " "	3/10
Potatoes " "	6/4½
Tomatoes " "	3/10

As in previous seasons, produce was shipped only to Messrs. J. Hunter White Ltd., St. John, New Brunswick: Messrs. J. W. Gorham & Co., Halifax, Nova Scotia; and Messrs. Mutual Brokers Montreal Ltd., and Messrs. Marshall and Morrison Ltd., in Montreal. These brokerage firms co-operated closely with the shippers of produce and with the Department and this opportunity is taken of gratefully acknowledging their assistance and efficient service.

The following table indicates the distribution of shipments to the three ports.

Commodity	Halifax	St. John	Montreal	Total
Beets (crates)	160	469	73	702
Cabbage "	541	645	174	1,360
Carrots "	4,073	4,435	2,457	10,965
Celery "	603	2,384	9,055	12,042
Onions "	382	557	630	1,569
Potatoes "	156	155	4,478	4,789
Tomatoes (lugs)	3,875	5,077	19,440	28,392
Miscellaneous	121	167	66	354
Total (packages)	9,911	13,889	36,373	60,173

Several small shipments of carrots and celery to Upper Canada were made via the United States, this being rendered possible by the extension of Most Favoured Nation Treatment on the part of Canada and by the excellent steamship service between Bermuda and New York. This route, though rather more costly than shipment to Montreal by Canadian National Steamship after the opening of the St. Lawrence River, has this great advantage that it enables smaller shipments to be made at more frequent intervals, and in this way the orderly marketing of the produce is helped.

The United States Market. The quantity of vegetables exported to the United States of America in 1937 was by far the smallest quantity in any year of which we have record. Only 14,419 bushels was shipped, consisting of potatoes and of Portuguese kale, as against 26,754 bushels in 1936 and 360,863 bushels in 1927. There was a further decline in the sale of Easter lily bulbs, but an increase in the number of lily buds and cut stems shipped to the United States.

Other Export Markets. The shipment of approximately 650 cwts. of new potatoes of Royal Kidney variety made to England under a marketing investigation of the Department of Agriculture is described in a later section of this Report in connection with work of the Department.

Small quantities of cabbage, carrots, onions and potatoes were sold in British Guiana and in some of the British West Indian islands.

The Domestic Market. The sale of produce locally continues to suffer from lack of any organisation of production or marketing. Most of the selling is done by the growers themselves who make their own arrangements with hotel-stewards or store-keepers. Much of the selling is too haphazard, a grower who has vegetables to sell often bringing a load to town in order to dispose of it as best he can. This results in price-cutting and in disorderly and uncertain marketing. Housewives who live near the

main roads have little difficulty in obtaining regular supplies of vegetables, since in most districts farmers' carts make fixed rounds on certain days in the week peddling their wares. The Farmers' Market in Hamilton continues to be well patronised and to have a large turnover of locally-grown produce. About a dozen farmers rent stalls there, selling their own produce so far as possible and buying from other growers when they run short. Unfortunately the building in which the market is housed has little to commend it beyond its ideal position, for it is so small as only to allow of a few vendors and even so is congested and ill-lit, not permitting of an attractive and tidy display of produce.

Organisation of the domestic market is much more difficult to arrange than the orderly marketing of export produce, on account of the many and diverse channels through which local sales are made. At the present time however the domestic market is many times more valuable than any export market, and it is accordingly of importance that the use of home-grown produce should be developed to the full. The Department has made a start by endeavouring to stimulate the local poultry industry, and it is proposed to extend this effort much more widely in a study of the requirements of the local market for vegetables and dairy produce, and of means whereby these requirements may be effectively filled by local production.

The Chief Crops: Potatoes. The potato crops, which at one time provided the greater proportion of Bermuda's vegetable exports, are now chiefly produced for domestic consumption. Two main crops are grown; the Bliss Triumph crop planted in September and dug in December or January, and the second crop consisting of Chili Garnet, Irish Cobbler, or Katahdin varieties planted in January or February and dug in April or May. The Triumph crop planted in the autumn of 1936 remained relatively free from blight and, though the disease was more common on the Garnets and other varieties of the second crop, it did not cause serious loss. The second crop yielded poorly from other causes, namely drought at the time of planting which affected the stand, and wind early in April which shortened the life of potatoes in exposed fields.

The quantity of potatoes exported was much less than in previous years but on the other hand the prices obtained were well above the average. In the local market good prices were maintained, thanks in part to the small second crop. Increased use was made of cold storage in order to hold potatoes till late in the summer when prices are usually at their highest point.

With the exception of a small consignment from Long Island, all of the Bliss Triumph seed imported in the autumn of 1937 was obtained from the Maritime Provinces, and was of high quality. A few bags of the same variety grown in Tennessee, imported as a trial sample, also proved good. The crop grew luxuriantly and heavy yields were obtained towards the close of the year. Unfortunately an epidemic of blight started shortly before the time of digging and as a result of neglect of spraying on the part of many growers heavy loss through tuber-rot was suffered. Small shipments made to New York late in November and early in December fetched excellent prices.

Tomatoes. The main crop of tomatoes for export was extremely late so that the quantity shipped to the end of May amounted to only 39 crates as against 7,232 for the month of May 1935. This lateness was in

part attributable to damage to the young plants caused by wind early in April, the damage being encouraged by neglect of bushing on the part of most of the growers. This practice, which was almost universally employed a few years ago, consists of placing small boughs and brush wood along the rows, so that the tomato-plants are supported instead of creeping over the ground and also are to some extent protected from wind.

It seems also to be the case that the majority of growers sow all their seed about the same date and rather later than was formerly the custom, and as a result the crop comes on all together and lasts a short time. A better arrangement would be for each grower to sow his seed in two or three batches planting the earlier lots in the most sheltered places and bushing the plants to give some protection from wind.

The crop was a small one of indifferent quality, which again is possibly to be attributed to the abandonment of bushing, and the prices obtained were below the average for the past few years.

Carrots. The most profitable vegetable exported to the Canadian market was carrots which realised an average selling price of $2.24 per bushel crate. This is the highest average price obtained in any year since shipments were made from Bermuda to Canada, and was due largely to a crop-failure in other districts which normally provide strong competition. The occurrence was exceptional and need only be expected to recur at rare intervals.

Celery. The celery crop provided the greatest disappointment in the export market. During the earlier part of the season the celery was of fine quality and seemed to justify the opinion expressed by an experienced grower that no finer celery had ever been shipped from Bermuda. It arrived however on a market already overloaded with celery and fetched very poor prices. Later in the season the crop suffered badly from Septoria blight and was of poorer quality. While there are on the market large supplies of celery from Florida and California, carefully graded in the packing-house, washed and pre-cooled in ice-cold water, and immediately transferred to the refrigerated car in which it travels to market, the celery from Bermuda, packed in the field and standing several hours and sometimes two days on the dock at air temperatures of 65° — 80° before being cooled in the ship's hold, has little chance of competing profitably. In this connection the Plant Pathologist's observations described on a later page on the wilting of Bermuda celery between the time of reaping and shipment are of interest. Until efficient means are provided for grading, washing and pre-cooling there seems little prospect for the celery crop in overseas markets.

Other Vegetables. The quantity of beets shipped to Canada was small but a very good price was obtained, and a moderate increase in area planted to this vegetable would appear justified. This vegetable is often scarce in the local market throughout the winter months owing to destruction of plants by the Pyralid *Hymenia fascialis*. The onion crop was very small and of poor quality, but the meagre quantity shipped sold well. Very little cabbage was exported and it sold at a poor figure.

Bananas. No bananas are exported but local demand continues to be fully supplied by the domestic supplies. In one plot which was under observation the drought in summer severely affected the yield of bunches, but as supplies at this season tend to be excessive the reduction was of little consequence.

Easter Lilies (*Lilium longiflorum var. eximium*: trade name *Lilium Harrisii.*) The lily bulb industry not only failed to show the expected measures of recovery but actually suffered a decline. The total exports amounted to 2,346 cases of bulbs as against 2,578 in 1936 and 7,611 in 1928. The following table shows the exports of bulbs in the past five years.

Year	Lily Bulbs Exported
1933	2,014 cases
1934	2,309 "
1935	2,490 "
1936	2,578 "
1937	2,346 "

In addition to the sale of bulbs, some growers found a profitable sale locally for the flowers, and 7,423 boxes of buds and cut stems were exported. The area planted to lilies has shown a small increase each year since 1934 though the number of growers has continued to fall.

Year	No. of growers	Area in Acres
1933	70	33.0
1934	61	20.2
1935	51	24.3
1936	53	26.5
1937	46	28.5

The area planted in the autumn of 1937 for the 1938 crop is estimated at 32.9 acres, thus showing a further small increase.

As usual, all fields were inspected at least twice during the growing-season by the Plant Pathologist, and certificates authorising the sale of the bulbs were granted only to those growers whose fields satisfied the requirements of the Department with respect to disease.

The decline in the export of bulbs in 1937 was largely due to reduced sales in the United States of America. This may have been in part an effect of the severe recession in activity which trade was suffering at the time the bulbs were shipped. But it has also to be admitted that the market for the Harrisii lily is limited and seems to be becoming more narrowly limited.

A similar condition is indicated by Messrs. Robert Tucker & Co. in their very able report on the bulb trade in the British Isles. During 1937 one more case of bulbs was sold in Great Britain and Ireland than during 1936, and Messrs. Rob't Tucker & Co. report that, so far as they heard, all customers were perfectly satisfied with their deliveries. But, in view of the fact that the year 1937 was in general a year of great prosperity in the United Kingdom, the lack of life in the sales of Bermuda bulbs was disappointing and lends support to the view that any significant expansion in the sales of Bermuda Harrisii in the British Isles is unlikely. Indeed Messrs. Rob't Tucker & Co. stress the view that large quantities of Bermuda-grown bulbs can only be sold in Great Britain if they are of the type which the commercial grower uses and demands. To quote their words: "The type of lily required is the Black-stemmed Takesima, commonly called Longiflorum Giganteum, or "Gig." by the trade. It is not quite such a graceful plant as a well grown Harrisii, but it is much superior to

any other Longiflorum for market growing on a large scale, because it withstands the bad effects of prolonged storage and of hard forcing under glass in our unfavourable conditions. Also the toughness of the blooms permits handling in showrooms and travelling long distances. In a word, the "Gig." is the established lily of commerce, and no other will be accepted. We trust we may be allowed to put forward a very strong plea that the commercial production of Takesima lilies should be considered very carefully by all concerned. We are convinced that it offers the main hope of selling really large quantities of Bermuda bulbs in this country."

The lack of interest shown in the Harrisii lily abroad has led growers in Bermuda to look for other types which might find greater demand, and several growers have other varieties of *Lilium longiflorum* on trial. A variety raised from seed by Mr. H. E. D. Smith, St. Davids, appears to have outstanding qualities, since it blooms some weeks earlier than Harrisii and possesses flowers of firmer texture. A sample sent for trial to the Royal Botanic Gardens, Kew, received favourable comment. Efforts of the Department in the search for an improved lily are described in a later section of this Report.

The following are further extracts from the report written by Messrs. Rob't Tucker & Co.:

"In our last report we mentioned the desirability of experimenting with packing in grease-proof paper. A few cases were sent in this way; and, although they suffered rather badly from breakage, the condition of the undamaged bulbs was good. In view of the great saving in weight, we recommend further experiment to see whether this form of packing can be made safe. Several of our buyers expressed the opinion that it would be a desirable change for such proportion of their orders as are for immediate delivery to their customers. They consider, however, that sand is better for bulbs which are likely to be kept in warehouses. Therefore, even if the greaseproof method can be perfected, it is not likely that it could be adopted for more than a proportion of the shipments.

The usual displays were made, that in Hyde Park being particularly effective, and reflecting great credit upon the Superintendent, Mr. Hay. At Kew, ordinary Harrisii were preceded two weeks earlier by some very good plants grown from a special strain produced by Mr. H. E. D. Smith. Bermuda Harrisii were also grown and included in the British Empire Section at the Chelsea Show, where they attracted attention and favourable comment. As in past years, a box sent by your Board was sent to Windsor. In view of Their Majesties' keen interest in flowers it is likely that the lilies will give much pleasure."

The very keen efforts to promote the sale of Bermuda lilies made by Messrs. Rob't Tucker and Co., and the assistance given by Mr. Lawrence Ogilvie and by Mr. Burn are gratefully acknowledged.

Milk. The number of dairy cattle in the Colony in 1937 was estimated at 1770 as compared with 1500 in 1932, so that it is evident that an increase in dairying has occurred in recent years. In spite of the existing high selling-price of milk, producers argue that it is difficult enough to show a scant profit, and on the other hand any large increase in the use of milk is unlikely to occur until it is obtainable at a lower price.

A critical study of the cost of producing and retailing milk would be of value. The indications are that the profits are largely swallowed up by the inordinate cost of delivering the milk to the consumers. Indeed it is alleged that in certain residential districts it is possible to count the employees of twelve or fifteen dairies in one day passing along the same road delivering milk to the residents. Needless to say it is mainly the consumer who pays for this replication of effort and he is seldom sufficiently alive and vocal to demand a greater measure of efficiency.

The proposal emanating from the General Board of Health for the establishment of a central pasteurising plant to which producers could deliver their milk in bulk and from which the pasteurised milk could be delivered systematically once a day to consumers in the central parishes has much to commend it not only from the point of view of public health but also from that of public economy.

Poultry. At the instigation of the Department, owners of poultry were encouraged to meet together and to re-organise the Bermuda Poultry Association, with the object of reviving interest in the keeping of poultry and of encouraging the increased production of poultry to fill the local demand. Official figures show that in 1936 approximately 2½ million eggs were imported into Bermuda in spite of a protective customs duty varying from 2d. to 7d. per dozen eggs according to season and country of origin, and a high ocean freight. Producers assert that during a large part of the year it is impossible to compete with foreign supplies owing to the high cost of feed and labour locally. The high cost of feed and labour is undeniable and it is probably the case that much of it is wasted on hens that are not worth feeding and in methods which are inefficient. It is more accurate to say that it is impossible with out-of-date and haphazard barnyard methods to compete against the up-to-date organized production of neighbouring countries. Until Bermuda eggs can be produced in steady quantity and supplied in properly graded and packed condition, imported eggs will continue to hold their own. The organisation and modernising of poultry-keeping has a prominent place in the Department's programme.

Other Animal Products. With the exception of veal, a quantity of which is raised locally, almost all the meat consumed is imported. The use of homegrown pork, and accordingly the raising of pigs, has declined much in recent years, the local product being considered of inferior quality to the pork imported from other countries. A few bee-keepers find a ready market for their honey and their seems little doubt that with a little effort a profitable market could readily be developed.

WORK OF THE DEPARTMENT.

For the past three years the Department has been working under great difficulty on account of vacancies in the staff. It has been necessary for the remaining officers to take over extra duties and, while this has been done loyally and without complaint, the work of the Department has inevitably been cut. Most officers have had to give the greater part of their time to the essential routine duties, and far too little time has been available for research and experimental work. With the appointment of a Horticulturist in October however the Department reached full strength for the first time since 1934, and is now in a position to embark on a much more ample and useful programme of work. The main activities of the Department are outlined in the following pages.

EXPERIMENTAL WORK: **(1) Soil Survey.** A preliminary survey of soils in different parts of the Islands was made by the Plant Pathologist with the aid of other members of the Department. While all the soils are highly calcareous, overlying aeolian limestone rock, they vary in texture from a light sand to a heavier soil of deep-red colour, locally known as "clay". Assistance in the analysis of soil-samples was kindly offered by Prof. F. Hardy of the Imperial College of Tropical Agriculture in Trinidad, but results are not available for inclusion in this report. It is hoped that these analyses will prove valuable in enabling a sound understanding of the nature of the soil to be gained and in indicating proper systems of manuring and tillage.

(2) Pasture Research. In the Report of the Department for 1936 it was pointed out that dairymen were to a large extent dependent upon imported feed for their cattle, and that the high cost of this feed was instrumental in keeping high the price of milk and in prohibiting its use by a large section of the community. During the year under review means of increasing the supply of inexpensive locally-grown feed were considered.

Cows graze on the natural pasture, usually on the hillsides under cedar-trees (*Juniperus bermudiana*), the beasts either being tethered singly or else moving freely in a fenced area. The natural pasture consists largely of the grass *Stenotaphrum secundatum* Kuntze, and weeds, amongst which leguminous plants are few or lacking. On some farms fodder-crops such as maize or Guinea corn are grown, and the remnants of vegetable crops, carrot tops and culls, sweet-potato vines and the like, are available at times. Silage is used to small extent.

The advice of the Imperial Agricultural Bureau at Aberystwyth was sought on means of improving the feed-supply, and this opportunity is taken gratefully to acknowledge the assistance readily given. At the Bureau's suggestion, attempts are being made

(1) to improve the feed-value of natural pasture by manurial treatment.

(2) to enrich natural pasture by introducing valuable species of grasses and clovers.

(3) to increase production of valuable fodder-crops.

As a start it was found necessary to become familiar with the plant species occurring in grassland, and to find if the pasture at the Agricultural Station was sufficiently typical of pastures throughout these islands to be used for experimental work. For these purposes a Specific Frequency Count was made in a few pastures. Without going into detail, it may be said that the number of grass species recorded was small *Stenotaphrum secundatum* was universally the dominant species while *Sporobolus berteroanus, Paspalum ciliatifolium,* and the sedge *Cyperus rotundus* were found commonly in all pastures, the last however in small volume. *Cynodon dactylon* occurred in quantity in some pastures but was lacking in others, while *Paspalum dilatatum, Eustachys petrea, Syntherisma longiflora* and *S. sanguinalis* were found to small extent in some pastures only. The weeds *Lippia nodiflora, Borreria laevis, Dichondra carolinensis,* and *Plantago lanceolata* were common in all pastures. *Medicago lupulina* occurred commonly during the winter months but disappeared with the coming of warm weather.

Fifteen plots measuring 1/100 acre were marked out on pasture at the Agricultural Station and a Percentage Area count was made of the herbage on each. The plots were arranged in five groups of three, of which one plot in each group was given an application of superphosphate at the rate of 3 cwts. per acre, another a mixed fertiliser containing superphosphate 3 parts, sulphate of potash 2 parts, and sulphate of ammonia 1 part, at the rate of 3 cwts. per acre, and the third was left untreated.

Seed of a selection of clovers was kindly supplied for trial by Dr. E. A. Hollowell, Bureau of Plant Industry, United States Dept. of Agriculture, and seed of other leguminous plants was obtained from various sources. It is hoped that amongst these different species there may be found some which will prove successful.

(3) Work on Lilies. Work was continued on the hybridization of varieties of *Lilium longiflorum* with the object of obtaining an improved form combining the early-flowering habit of the Bermuda lily (variety *eximium*) with the storage qualities and the form and texture of flower possessed by other varieties. A small consignment of *L. longiflorum* var. *takesima* (the "giganteums" of commerce) was planted at the Agricultural Station for purposes of trial.

Plants of *Lilium longiflorum* with severe chlorotic symptoms made a recovery to normal appearance after injection with a dilute solution of ferrous sulphate. Similar plants, injected with water as a check, remained chlorotic.

(4) Termite Investigation. During July the occurrence of adult termites round lights in the evenings led to a search being made for termite nests. These were found to be very common in trees, and a count made of 100 cedar-trees, (*Juniperus bermudiana*) at the Agricultural Station showed 38 to contain colonies of termites. Entry had usually been made through the stump of a broken branch or through a wound in the trunk. The pest was also found in woodwork of all kinds, riddling the wooden walls of barns, tunnelling in posts and gates, and penetrating the beams of houses. All the termites so far obtained in Bermuda have been dry-wood termites but it is not yet clear whether only one species is involved or more. The Plant Pathologist gave a number of talks on damage caused by termites and means of controlling them. An account of his researches on the subject will be found in the Report of the Plant Pathologist. It is not suggested that attack by termites is a new thing in Bermuda but rather that it has been going on disregarded for a very long time. It is however strange that up till now termites have not been recognised as the chief enemy of timber in Bermuda and as causing incalculable material loss to the community.

(5) Diseases and Pests of Cedar. Following numerous complaints as to diseased condition of *Juniperus bermudiana* particularly in the parishes of Smiths and Devonshire, the Plant Pathologist made a rough survey of cedars throughout the main islands, noting the extent and, where possible, the cause of trouble. The findings of his survey are described fully in the Report of the Plant Pathologist. One of its chief results was to indicate that in most estates poor condition of cedars was due to neglect on the part of the owners, the trees having grown up where they sowed themselves in a hopeless state of overcrowding, and being left to struggle on without thinning, pruning, or attention of any kind. The Plant Pathologist gave a series of talks on the proper care of trees,

including demonstrations of correct methods of pruning, and he arranged a most interesting exhibit at the Agricultural Station showing the most important diseases and pests of cedar. This exhibit was open to view by the public for some weeks and was much appreciated by those who saw it, though the number who came was not so large as the exhibit merited.

(6) Defects of Celery. Amongst other experimental work done by the Plant Pathologist an investigation of defects in celery was of special interest. The chief complaints regarding celery from Bermuda in Canada refer to Septoria blight and to wilted condition on arrival. The amount of wilting, based on water-loss, under existing conditions of harvesting was measured. Crates of celery were weighed in the field, stacked for some hours on the dock, and then held at the local Ice Factory for a week (representing the period in ship's chill-room) after which they were re-weighed. The loss in weight varied from 1½ lbs. to 7½ lbs. per crate or from 2.6% to 11.3% of the weight of the celery. Greatest loss occurred in crates which had been stacked on the dock in a draught of air at the door of the shed. Individual sticks in the crates were weighed and it was found that those on the outside of the crate lost about twice the amount of water lost by sticks inside.

The enormous water-loss taking place indicates the fault of present methods of harvesting, and the great need for a pre-cooling plant with controlled humidity to which the celery can go from the field without delay. It also suggests that trials should be made of methods for preventing water-loss, for example by the use of paper liners in the crates.

(7) Varietal Tests of Vegetables. New varieties of several vegetables were grown in plots under observation. Good results were given by varieties of cauliflower obtained from Messrs. Sutton & Sons, Calcutta, and grown in the summer months. Though checked by the unusually dry conditions, they recovered on the coming of rain and headed well, the varieties Early Benares and Early Market giving best results under the conditions of the experiment.

MARKETING SERVICE AND INVESTIGATIONS. The Agricultural Assistant was stationed in Canada during the main shipping-season and he supervised the marketing of produce on arrival there. Through him the Department was kept informed as to developments in the market and was thus enabled to advise growers and shippers as to prospects and prices and the most promising allocation of shipments to the three ports.

Under a scheme approved by the Board of Agriculture for investigating a market in England for early potatoes, growers were guaranteed a price for Royal Kidney potatoes packed by Government and shipped to England before the middle of April. A total of 1293 bushels, or nearly 650 cwts. was shipped to Messrs. Rogers White & Co. Liverpool, and sold at prices ranging from 8/- to 10/3d. per bushel with an average of 9/4d. Freight and selling-charges were heavy averaging 3/10d. and, if we also subtract cost of the crate, the nett price works out at 4/8d. per bushel. This is not regarded as a high price in Bermuda, but since it applied to all sound potatoes varying from large to very small size, such a return should be profitable in seasons when a good crop is reaped. Following representation made to shipping-companies and to Messrs. Rogers White & Co., small reductions in freight and selling-charges have been promised for next season, which should assist in making the venture more nearly profitable.

GOVERNMENT PACKING OF VEGETABLES. Vegetables were graded and packed for growers at the main Packing-House at the Agricultural Station throughout the shipping-season and at the supplementary Packing-House in Southampton Parish between 26th April and 19th June. A small addition to the north end of Packing-House No. 1 at the Station extended the space available for the handling of tomatoes, and, as the crop was a very small one, it was packed in the one house, and the second tomato-shed was not required. Of the vegetables shipped to Canada 37,167 crates were Government-packed and 23,006 crates (including 12,042 crates of Celery) were farm-packed. As yet the Department has no adequate facilities for grading celery and all the crop is packed in the field. Of the crates of tomatoes exported, 94% was government-packed.

The Packing-Houses were as usual under the efficient management of the Inspector of Produce, and further information as to quantities of produce handled will be found in his Report. As in prior years the cost of packing was not fully covered by the charges made to growers.

INSPECTION AND REGULATORY SERVICES. The Department was responsible for the administration of Byelaws regulating the following:

(i) Control of Animal Diseases. The Government Veterinary Officer examined all domestic animals landed in the Colony with a view to checking the introduction of serious disease. From the figures shown in detail in his report, it will be noted that there was an increase in the importations of horses and poultry.

In continuation of the joint scheme of the Board of Health and Board of Agriculture for the control of bovine tuberculosis, the Government Veterinary Officer tested cattle for this disease throughout the Colony. The test, which is made free of charge, is compulsory in the case of cows supplying milk for sale and is also applied to the majority of cows privately owned. Cattle which reacted positively to the test were slaughtered, compensation being paid by the Government. Tests to determine the incidence of Bang's Disease in dairy cattle were continued, 778 cattle in the western and central parishes being subjected to the blood-test. The results, published in detail in the Veterinary Officer's Report, show this disease to be of some consequence. Compulsory slaughter of infected animals is not required, but a proposal to compensate owners who voluntarily destroy infected dairy cattle is under consideration.

(ii) Control of Plant Diseases and Pests. The Plant Pathologist continued to be responsible for the inspection of plant material entering the Colony. Difficulty was experienced in preventing the importation of plants in soil, the recent byelaw prohibiting the entry of soil having apparently not been advertised sufficiently. The occurrence of plant diseases and pests and work done on their control are described in the Report of the Plant Pathologist.

Two horse-drawn spraying-machines maintained by the Department were available to farmers and gardeners for hire by the day, the one being stationed in Southampton Parish, the other at the Agricultural Station.

(iii) Inspection of Produce and of Nursery Stock. Vegetables for export were subjected to inspection, those packed by Government at the packing-sheds, and those packed on the farms at the docks where inspectors

were on duty throughout the shipping-season. Any vegetables in which serious defect was noted were condemned. An account of the condition of vegetables at the time of shipment is given in the Report of the Inspector of Produce.

The objects of this compulsory inspection are to ensure firstly that the quality of the shipment is sufficiently good not to degrade the reputation of Bermudian produce in the overseas market, and secondly that those who are shipping produce of high quality are not penalised by the inclusion in the shipment of low-quality produce, since the price of the whole shipment is liable to be based on the quality of its worst crates. These objects are to a great extent thwarted by the system of appeal against the Inspector's decision, provided in the Agriculture Act. In the event of produce being condemned by the Inspector, two impartial and disinterested persons may be requested to decide whether the produce shall be shipped or not. In the majority of cases the umpires chosen are kindly people desirous of helping the farmer and with no idea of the objects of the inspection or the point that the one farmer's lot has been condemned with the idea of maintaining the quality of the whole shipment and of protecting all the other farmers who have a share in the shipment. As a result the Inspector's decision is commonly reversed.

In addition to the inspection of lily fields made by the Plant Pathologist, an inspection of the bulbs at the time of packing was made by the Inspector of Produce. Other plants and bulbs intended for export were examined shortly before shipment, and only such as were found to be free from diseases and pests were passed as fit for export.

(iv) **Sale of Vegetable Seeds.** Loss was caused to several growers who purchased from a local seedsman celery seed which proved to be of a variety unsuited to local requirements. In order to prevent any recurrence, the Byelaws for the Sale of Vegetable Seeds were revised and brought up to date. Under these byelaws vendors of seed must be licensed with the Department and must submit samples of all stocks of seed of the following vegetables offered for sale: beet, cabbage, carrot, cauliflower, celery, onion, and tomato. Seed may not be sold until the sample has been tested, or if it is found to be unsuitable for planting on account of having low vitality or being a variety not approved for local cultivation or infested with harmful disease or pest.

HORTICULTURE: **Coronation Planting.** The Director acted as Chairman of a Committee appointed early in the year to make recommendations for tree-planting to commemorate the Coronation of Their Majesties King George VI and Queen Elizabeth. The proposal was made to the various Arbor Societies that a planting of trees or shrubs be made in each Parish, preferably at some central place which obviously called for improvement. Suitable plants were offered from the Agricultural Station and financial assistance for the actual planting from public funds, on condition that the Arbor Society accepted responsibility for the upkeep. Some of the parishes took up the proposal with enthusiasm and plantings were eventually made in all parishes but two. In addition to these community plantings, over 1600 seedlings of the scarlet Tulip-tree, *Spathodea campanulata*, grown at the Agricultural Station, were distributed a few days before the Coronation. These were sent to one or two central places in each parish and one tree was given to anyone who cared to plant it in his garden. A leaflet of instructions for the planting and care of the tree was

issued. At the same time Mr. J. D. C. Darrell supplied trees imported by himself to churches and Schools throughout the Colony for commemorative planting.

During the year a large number of plants were supplied to Arbor Societies for roadside-planting in various parishes, to schools, and to bazaars in aid of charitable funds. Plants not ordinarily obtainable from florists in Bermuda were sold at a low price to private persons. Advice and assistance were given whenever possible to the Garden Clubs and Arbor Societies, and many requests from residents and visitors interested in gardening on the laying-out of grounds and the care of plants were given attention. Thanks to the appointment of a Horticulturist the Department is now able to give a greater measure of assistance in the various branches of Horticulture, and this officer has made an energetic start in introducing new plants and in developing the commercial cultivation of flowers and fruits.

OFFICE WORK. The clerical work, involving correspondence on agricultural and departmental matters, the keeping of financial accounts, and the keeping of records in connection with Government-packing, was performed efficiently, and the Clerk deserves credit for her able work. Letters received during the year numbered 800 and those despatched 1100.

The Agricultural Bulletin completed its sixteenth year in 1937 but was issued in nine numbers instead of monthly as formerly. It was distributed not only in the Colony but also to Departments of Agriculture and other institutions in many countries.

A large number of publications were received from Departments of Agriculture and Colleges in many parts of the world, and this opportunity is taken gratefully to acknowledge them.

THE AGRICULTURAL STATION. The grounds of the Department combine, so far as their limited area will permit, the functions of an experimental ground, a botanic garden, and a public park. The last function is unfortunately detrimental to the first two, experimental results and the collection of plants suffering continually from depredations of the public. Investigations on the growing of fruit can only be carried out with the greatest of difficulty.

(1) Vegetable Plots. Some of the vegetable plots were cropped three times and others four times during the year. Crops grown in the plots included potatoes (for varietal tests and marketing investigations), tomatoes, cauliflower, lilies and ground-nuts (for varietal and other tests), carrots and onions (for pathological work). On most plots cowpeas were planted in the summer and ploughed in as green manure. Farmyard manure was applied to most plots before the soybeans were planted, and an application of fertiliser was also given to most of the crops.

Part of the vegetables obtained was supplied to the Hospital and a small amount was sold locally at times when it did not compete with home grown commercial supplies. Most was used for experimental shipments to various markets.

(ii) Ornamental Plots. Until the appointment of the Horticulturist the Station Foreman was responsible for the upkeep and propagation of the ornamental trees, shrubs, and flower-plants. During the Spring and

early Summer there was a very fine show of annuals. In the Summer plantings were made of over forty trees and shrubs, mostly of species not already present in the Garden. Work done since then is described in the Report of the Horticulturist.

The Department is indebted to numerous individuals and to other Departments for gifts of seeds.

(iii) Livestock. The small herd of pure-bred Guernsey cattle was improved by the addition of a young bull Indian Ladder Butter Girls Brave purchased in January from Mr. P. G. Ten Eyck, Albany, N. Y.

(iv) Visitors. The Station was visited by a large number of people including residents as well as tourists, and many expressed interest in the work being done and in the collection of plants.

Distinguished visitors included His Excellency the Governor of Bermuda Lt. Gen. Sir Reginald J. T. Hildyard, K.C.B., C.M.G., D.S.O.: the Hon. A. W. G. H. Grantham, Colonial Secretary: Lady Best, Admiralty House: Mr. J. Sydney Dash, Director of Agriculture, British Guiana, and Mrs. Dash: Dr. C. W. Wardlaw, Imperial College of Tropical Agriculture Trinidad: Mr. F. E. V. Smith, Department of Agriculture Jamaica: Mr. Rex Stollmeyer, Trade Commissioner for B. W. I. in Canada, and Mrs. Stollmeyer: Dr. Wm. Beebe, New York Zoological Society, and Mrs. Beebe: Capt. H. A. Johnstone, London: Dr. H. L. Russell, University of Wisconsin: Mr. Earl S. Johnston, Smithsonian Institute Washington D.C.

MEETING OF THE WEST INDIAN FRUIT AND VEGETABLE COUNCIL (EASTERN GROUP). The Chairman of the Board (the late Hon. G. S. Patton) and the Director attended the Second Meeting of the West Indian Fruit and Vegetable Council (Eastern Group) held in Trinidad from 24th February to 2nd March. Most of the discussions dealt with problems of shipping and marketing and, though the crops considered were in the main not those grown in Bermuda, the problems themselves were similar to ours. It was therefore of value to note the ways in which they were being met elsewhere and especially to note how growers and shippers in some of the West Indian islands have proved the profitableness of a greater measure of co-operation than is to be found in Bermuda. Other matters discussed included the steamship service and the refrigerated space on steamships between the West Indies and Canada, and the adverse effect of the recently revised Canadian Customs Tariff on the vegetable trade.

As valuable as the actual discussions of the Council were the opportunities provided of seeing the work of the Imperial College of Tropical Agriculture and of the Departments of Agriculture in Trinidad and in the several islands visited on the way south. In each island the facilities for sale of local vegetables and for pre-cooling of export vegetables and fruits were studied. The delegation brought back many useful points in connection with the growing of crops and their marketing, in addition to a small collection of interesting plants for trial.

BOARD OF AGRICULTURE. During the year eleven meetings of the Board were held, and these, and additional meetings of two committees appointed to consider Cold Storage and Improvement of Livestock, were attended by the Director as technical adviser.

To members of the Department the sudden death of Hon. George S. Patton on 25th March came as a personal loss. As Chairman of the Board he had been closely associated with the Department for more than three years and by his wisdom and kindliness he had won the sincere respect and esteem of the staff.

ACKNOWLEDGMENT. It is a pleasure to record the cheerful, loyal, and conscientious manner in which officers of the Department have performed their duties during the year.

III. STAFF.

Mr. T. A. Russell, Director of Agriculture, was absent on vacation leave from the beginning of the year till 20th January. From 21st till 23rd January he was present at the Conference of the Canadian Fruit and Vegetable Jobbers Association in Montreal. He attended as official delegate the Second Meeting of the West Indian Fruit and Vegetable Council (Eastern Group) held in Trinidad between 24th February and 2nd March. During the year he served on the Board of Immigration.

Mr. J. M. Waterston, Plant Pathologist, was on duty in Bermuda throughout the year.

Mr. W. R. Evans, Agricultural Assistant, acted as Director from 1st to 25th January, and from 17th February to 12th March. He was absent from the Colony on duties in connection with marketing of vegetables in Canada from 7th April to 26th July. In November he was elected Assistant Hon. Secretary of the Bermuda Poultry Association.

Mr. G. R. Groves arrived in the Colony on 26th October to take up the duties of Horticulturist. In addition to experience in practical market-gardening, he has had the benefit of several years' work at the University Botanic Garden, Cambridge and the Royal Botanic Gardens, Kew.

Mr. T. A. Hollis, Inspector of Produce, combined with his inspecting duties the efficient running of the Government Packing-Houses. He was on vacation leave in Bermuda from 15th November to 6th December.

Miss Nora E. Hollis, Clerk to the Board and Director was responsible for the clerical work and book-keeping of the Board and Department of Agriculture, and of the Government Packing-Houses.

Dr. C. J. Cooper, Government Veterinary Officer, was on leave from 24th October to 14th November during which period Dr. J. W. Sutherland acted in his stead.

Mr. C. V. S. Early, Station Foreman, was in charge of operations on the Station grounds throughout the year. During the shipping-season he was appointed Assistant Inspector of Produce, and Messrs. A. W. Fowle and T. J. Outerbridge acted as Sub-Inspectors.

IV. FINANCIAL.

The expenditure of £3,333. 0. 0. in Personal Emoluments was authorised by the Appropriation Act of 1936 and of this sum £2,800. 19. 8 was expended. The sum of £7,570 was appropriated for other purposes by

the Appropriation Act of 1936 and by Supplementary Resolve No. 36 of 1937, and £4,973. 3. 5 was spent. Reimbursements to the Treasury for charges made for packing vegetables and for the sale of vegetables and plants amounted to £846. 2. 5. The nett expenditure of the Department, exclusive of Personal Emoluments, was therefore £4,127. 1. 0.

Year	Gross Expenditure	Reimbursements	Nett Expenditure
1928	£4,038 12 7	£ 157 10 8	£3,881 1 11
1929	4,184 6 10	193 0 1	3,991 6 9
1930	6,500 16 2	247 18 9	6,252 17 5
1931	6,984 18 9	280 1 1	6,704 17 8
1932	6,745 2 4	466 7 1	6,278 15 3
1933	10,191 17 0	2,434 9 7	7,757 7 5
1934	9,905 10 11	2,409 6 9	7,496 4 2
1935	6,570 16 10	3,163 18 11	3,406 17 11
1936	5,999 16 4	1,813 5 2	4,186 11 2
1937	4,973 3 5	846 2 5	4,127 1 0

In addition to these departmental votes, financial assistance was given by the Government to agriculture by the payment of a subsidy from votes of the Trade Development Board to provide increased facilities for the shipment of vegetables.

Respectfully submitted,

T. A. RUSSELL,

Director of Agriculture.

23rd March, 1938.

Report of the Plant Pathologist, 1937.

The Director of Agriculture,

I have the honour to submit a report of my observations and research work on plant diseases and pests during the year 1937.

GENERAL REVIEW

Although there were no outstanding epidemics of pests or diseases of economic crops during the year under review, the annual toll exacted by insects, fungi and bacteria as agents in the deterioration of agricultural commodities, was as high as in previous years. The enormous loss sustained by crop products in Bermuda as a result of unnecessary wastage, constitutes one of the most serious problems confronting the farmer in these Islands today.

A considerable proportion of the time available for research during the year was accordingly devoted to the study of some of the factors contributing towards these losses. Details of this work are given in a later part of this report. It is sufficient to remark here, that the farmer was not found to be entirely responsible for the present lamentable state of affairs, although a great improvement could undoubtedly be immediately effected, if more attention were paid to a proper system of crop rotation and the grading of produce.

There are however, certain factors affecting the problem of wastage, which are at present beyond the control of the farmer. Chief of these is the lack of adequate cold storage facilities. As a result, crops are harvested, not necessarily at the proper stage of maturity, but at a time ordained by the arrival and departure of the steamships. Moreover, in order that the produce may be packed ready in time for shipment, harvesting may take place as early as two days in advance of the vessel's arrival. The consignments may be left standing about in the fields or at the dockside, an exposure which inevitably leads to disastrous results, especially with a perishable commodity such as celery. Deterioration under these conditions is also rapid among other crops. Consignments of carrots for example, have been intercepted on the dock, which showed characteristic symptoms of wastage due to the fungus *Sclerotinia sclerotiorum* (Lib.) de Bary, clearly visible through the slats in the crate.

During the month of March, when the demand for new carrots in the Canadian market is small, the brokers are often unable to dispose of the consignments of carrots for several days. Under these conditions *Sclerotinia* rot sometimes develops to such an extent as to necessitate repacking. This naturally results in smaller returns to the grower.

Proper facilities for grading and pre-cooling will go a long way to solve our present problem of wastage. Indeed these facilities are absolutely essential if we are to consider competing in an export market where only the very highest standards are demanded.

Shortly after my arrival in the Colony, I was greatly impressed by the lack of attention given to the endemic "cedar", *Juniperus bermudiana* L., the locally dominant tree which supplies the most characteristic feature of

the Islands' vegetation. The need for some scientific system of sylviculture and reafforestation in Bermuda is everywhere in evidence. With very few exceptions, the cedar trees are allowed to spring up in a haphazard fashion and are completely neglected. Under these conditions, diseases and pests are given unrestricted opportunities for spreading. In many areas, the intrusion of competing vegetation has been allowed to proceed to such an extent that the cedars are dying out and present a very unsightly appearance.

Quite apart from reasons of aesthetic appeal, there are other arguments for showing cedars to merit greater attention than they have received in the past. Bermuda cedar has a commercial value in the Colony of 1/6d a foot, equivalent to that of Mahogany, and an increasing use is being found for the wood in house construction and in the souvenir trade. One large store alone, for example, sells over 1,000 cedar bag handles regularly every year. Unless steps are taken to maintain the natural resources of timber in the Colony, there is a very real danger of a shortage of marketable cedar in the near future.

Several diseases of the crops in Bermuda appear to be due to deficiencies in nutrient elements in the soil. A preliminary soil survey was undertaken during the summer months, and samples from soil profile pits made at different localities throughout the Islands, have been forwarded to Prof. F. Hardy at the Imperial College of Tropical Agriculture in Trinidad, B. W. I. for analysis.

Work was continued on the application of methods of biological control of insect pests. Through the courtesy of the United States Department of Agriculture, the Imperial and Pan American Airways, and the Imperial College of Tropical Agriculture, arrangements were completed for the importation of *Dasyscapus parvipennis* Gahan, in an attempt to control the onion thrips, *Thrips tabaci* Linde. Since this pest is a limiting factor to onion production in Bermuda at the present time, its control is a matter of considerable economic importance.

MAJOR PROBLEMS INVESTIGATED

FACTORS AFFECTING WASTAGE IN BERMUDA VEGETABLES.

There are several field conditions encouraging the spread of fungous diseases among crop plants in Bermuda. One most important factor is the high relative humidity, which averaged 77% for the present year. The local practice of close planting in order to minimise wind damage, further increases the humidity within the crop. The absence of frost and the lack of systematic crop rotation are both responsible for the accumulation of many soil-borne diseases. Of these the following may be mentioned:— the ubiquitous **Sclerotinia sclerotiorum* (Lib.) de Bary; the blights of potato, **Phytophthora infestans* (Mont.) de Bary; of celery, **Septoria apii — graveolentis* Dorogin; and onions, *Peronospora destructor* (Berk.) Caspary.

Where tomatoes are grown repeatedly without rotation, wilt disease, *Fusarium lycopersici* Speg. is commonly found, and during the summer both **Corticium rolfsii* (Sacc.) Curzi and **Corticium vagum* B. & C. are active on carrots and potatoes. Agricultural practices such as the interplanting of potatoes with tomatoes assist in the spread of the potato tuber

*Also responsible for wastage during storage.

moth, *Phthorimaea operculella* Zell., which causes very extensive damage during the warmer months to stored potatoes and to green tomato fruits. Other detrimental practices commonly observed are the growing of tomatoes on the ground without support, which increases wastage by cutworms, *Prodenia ornithogalli* Guen., or the neglect to remove weeds which encourage the spread of *Sclerotinia* and fireworms, *Xylomiges eridania* Cram.

Certain environmental factors, such as the height of the water table, have been observed to affect the time of appearance of the blights of potatoes (*Phytophthora*) and celery (*Septoria*), and these water relationships are being further studied. The state of maturity of the host plant has also a relation to the onset of wastage factors and there is some evidence that in celery, *Sclerotinia* and *Septoria* appear more severely on overripe plants in the field. To what extent the increased susceptibility of crops at maturity to the depredations made by fungi can be off-set by suitable manurial treatments, is a problem which merits further investigation.

Pre-harvesting factors—

There is probably no more destructive fungus to be found in Bermuda attacking such a variety of host plants, than *Sclerotinia sclerotiorum* (Lib.) de Bary. It is responsible at times for serious losses to cabbage, carrots, celery, lettuce, and tomato crops, not only in the field, but also during storage, especially when in transit to the Canadian market. A number of weeds and ornamental plants are also attacked. In the appended list of thirty-five host plants, (Table I), several of which are recorded here for the first time, it will be observed that the Easter lily, *Lilium longiflorum* var. *eximium* (Courtois) Baker, appears to be the only crop of economic importance which is not attacked.

A study of *Sclerotinia* in the field confirms the observations made in previous years, which have shown the mode of attack to be aerial and not through the soil. The apothecial stage has been found in nature during the winter months from January to March, the period in which the fungus causes most damage. With the approach of warmer weather during May and June, *Sclerotinia* disappears entirely, and its place is taken by *Corticium rolfsii* (Sacc.) Curzi. This latter fungus together with *Corticium vagum* B. & C. and *Rhizopus* sp. is responsible for both field and storage rots during the summer months. There is thus a succession of two quite unrelated fungi, *Sclerotinia* and *Corticium*, both however possessing in common a soil-borne sclerotial stage.

TABLE I.

LIST OF HOST PLANTS OF *SCLEROTINIA SCLEROTIORUM* IN BERMUDA.

	Local Name.
Antirrhinum majus L.	Snapdragon
**Apium graveolens* L.	Celery
Arctotis stoechadifolia Berg.	Blue Arctotis
Argemone mexicana L.	Mexican Poppy
**Brassica oleracea* L.	Cabbage
Calendula officinalis L.	Scotch Marigold
Centaurea Cyanus L.	Corn-Flower
Centranthus macrosiphon Boiss.	Sugar-Plum
**Cichorium Endivia* L.	Endive
**Cucumis sativus* L.	Cucumber
Cynoglossum furcatum Wall.	Chinese Forget-Me-Not
**Daucus carota* L.	Carrot
Delphinium Ajacis L.	Larkspur
Euphorbia heterophylla L.	Various-leaved Spurge
**Foeniculum Foeniculum* (L.) Karst.	Fennel
Fumaria muralis Souder.	Wall Fumitory
Galinsoga parviflora Cav.	Galinsoga
Gazania splendens Hort.	Elegant Gazania
Gerbera Jamesoni Bolus.	Tommy Atkins
Helichrysum bracteatum (Vent.) Willd.	Everlasting
Hibiscus sabdariffa L.	Roselle
**Lactuca sativa* L.	Lettuce
Lamium amplexicaule L.	Henbit
Linaria linaria (L.) Karst.	Toadflax
Linum grandiflorum Desf.	Flowering Flax
Lupinus sp.	Garden Lupine
**Lycopersicon esculentum* Mill.	Tomato
Malcolmia maritima (L.) R. Br.	Virginian Stock
**Petroselinum hortense* Hoffm.	Parsley
**Phaseolus vulgaris* L.	String Bean
**Pisum sativum* L.	Pea
**Solanum tuberosum* L.	Irish Potato
**Tragopogon porrifolius* L.	Salsify
Trifolium hybridum L.	Alsike Clover
Venidium decurrens Less. var *calendulaceum*	Garden Venidium

*Designates a crop plant.

A detailed survey of carrots growing at the Agricultural Station was made during February in which 6,505 plants were examined individually for the presence of *Sclerotinia sclerotiorum*. Three groups of leaves were recognised;—1) those free from disease, 2) those showing apical infection of the leaflets and 3) those showing a rot at the base of the petioles. This type of infection where the fungus was found penetrating the crown of the root was regarded as the most serious, since it is roots belonging to this class which act as centres of contamination when included in the crate by careless packers. Sample counts of infected plants from different parts of the field varied, but the average for the whole field was 28%. Roughly one third of the diseased plants were of the "basal" type of infection.

The importance of humidity in determining the spread of the disease was shown by the marked difference in the incidence of leaf infections on weeded and un-weeded plots. These are shown in Table II, which also includes the results of applying a top dressing of sulphur at the rate of 5 lbs. per sq. rod.

TABLE II.

Percentage Leaf Infection by Sclerotinia

Treatment	Apical	Basal	Total
Weeded	14.7	15.3	30
Un-weeded	31.1	19.9	51
Un-weeded + Sulphur.....	11.6	2.4	14
Average, Whole Field	19.0	9.0	28

As a result of weeding, the amount of apical leaf infection was reduced by about half that on the un-weeded plot. The success achieved by the use of the sulphur appeared to be due to its fungicidal action on the infected leaf when this fell to the ground, which prevented the fungus from spreading to the base of the plant. The low prices returned by carrots within recent years do not however permit the use of sulphur as a fungicide on a field scale. These figures are alarming enough when it is considered that the weather experienced during the spring was exceptionally dry, and not favourable to the spread of the fungus. Had damper weather prevailed, a larger proportion of the apical leaf infections recorded would have been transformed into basal ones and the chances for a greater amount of storage rot would have been increased.

Post-harvesting factors—

The most important factor in the depreciation of carrots during storage and in transit to market has already been mentioned to be the rot caused by the fungus *Sclerotinia*. In a cold storage experiment, it was found that if careful grading to remove roots infected in the crown from the basal type of leaf infection in the field was practised, an amount of infection was obtained which ranged from 0.0 — 4.0% and averaged 1.1% per crate. The point of infection was usually traced in crates of this type to a small portion of leaf which had remained attached to the roots as a result of incomplete washing. This acted as a food base for the fungus and enabled it to spread over the surface of the root until an entrance was established through a wound. Similar carrots packed by farm labour showed a range of 1.5—20.9% and averaged 8.5% per crate or nearly eight

times the amount of infection found in the graded roots. The above experiment thus emphasised the importance of rejecting material contaminated with disease, during packing. Clean cultivation in the fields, together with more careful grading and better facilities for pre-cooling and cold storage should materially aid in solving wastage problems of the above type.

Preliminary investigations were made into some of the principal causes of depreciation of Bermuda celery, from the time of harvesting onwards. These are wilting, as a result from water losses caused by undue exposure in the field, and the rots brought about by *Sclerotinia sclerotiorum* (Lib.) de Bary, *Septoria apii-graveolentis* Dorogin and *Bacillus carotovorus* Jones.

The importance of preventing undue water losses cannot be stressed too much, since the appearance and crispness of celery largely depend on the maintenance of a high water content. The following observations were made on the harvesting of a celery crop at the end of May. Sample crates of celery were lifted at hourly periods throughout the day and each head of celery was weighed separately and numbered before packing. The crates were stored in the local chill room for a length of time corresponding to the voyage to the Canadian market. At the end of this period the individual celery heads were re-weighed and the water loss determined. The position of each head of celery in the crate was recorded and maps of each crate were constructed showing the percentage of water lost in relation to the position of the celery in the crate. In one experiment, ten crates were selected, and their contents totalling 368 heads of celery, critically examined in order to determine the relation between position in the crate and percentage loss in weight. Three zones were recognised within the crate;—1) the periphery, 2) annular zone, (composed of celery heads not found in the periphery or at the centre of the crate), and 3) the centre. The figures obtained from each crate are summarised in Table III.

TABLE III

Percentage Loss in Weight of Celery Heads in relation to Position in Crate.

Periphery	=	14.9
Annular Zone	=	7.8
Centre	=	6.5

It will be observed that the celery heads in the periphery lost, on an average, twice as much water as did those in the annular zone and at the centre of the crate. In view of the fact that half the total water lost from the crate comes from the heads in the periphery, it would appear to be worth while to provide some form of protective wrapper, such as has been recommended in the United States in recent years.

Under the present conditions for shipping celery, farmers are required to trim off the green tops of the celery protruding from the crates. Comparisons between trimmed and untrimmed crates revealed that the untrimmed celery lost a greater percentage of water than the trimmed. Moreover when these figures were examined statistically, the difference between the two treatments was found to be significant. It was further observed that the amount of *Septoria* blight was reduced in the trimmed crates and that consequently they had a better appearance. Trimming is therefore to be recommended, both on account of the reduction in water loss and in the improvement in quality obtained.

An experiment made to determine the most suitable time of day for harvesting was invalidated by lack of speedy transport between the field and the chill room. The amount of water lost by individual crates between harvesting and marketing was found to range from 2.2% to 11.3% by weight according to the amount of exposure received. The greatest water losses were not however from crates which remained for the longest period in the field but those which had been left in a draught on the dock side. This clearly emphasised the necessity for pre-cooling facilities in Bermuda.

DISEASES AND PESTS OF THE BERMUDA CEDAR, *Juniperus bermudiana* L.

During the month of July, certain patches of cedars throughout the Islands became noticeably blighted in appearance. This took the form of a brown discolouration of both juvenile and adult leaves accompanied by defoliation of the shoots and branches. Although death of the tree was recorded in several instances recovery was observed in many cases. A parish survey revealed that most of the trouble was centred in Devonshire and Smith's, particularly where the trees were overcrowded and badly neglected. Although the survey gave no evidence of a widespread epidemic of cedar blight, it was apparent that the condition of the trees in the two above named parishes merited further investigation. The following pests and diseases were recorded from affected areas.

Insect Pests. One of the first problems requiring further study is the nature of the part played by the cedar scale insect *Chrysomphalus agavis* Ths. & Ckll. in relation to the blight. This small, dark brown conical scale which can be readily seen on the needles, is widely distributed over Bermuda and when abundant may lead to yellowing and browning of the foliage.

There are fortunately two beneficial insects which normally keep this scale under control, namely *Aphelinus diaspidis* Havard and *Aspidiotiphagus citrinus* Crawford. Local outbreaks of cedar blight in 1931, were attributed by Dr. H. S. Cunningham to the inactivity of these parasites as a result of some unknown environmental factor, with the consequence that the scale multiplied rapidly until sufficiently numerous to become destructive. Such occurrences are not unknown in biological control and are well illustrated by the occasional severe outbreaks of Oleander scale, *Aulacaspis pentagona* Targ. and Palmetto scale, *Comstockiella sabalis* Comst., which still take place in Bermuda from time to time.

Among the other pests associated with the blighted condition of the trees, whose harmfulness has not yet been fully assessed, are several species of mites and one psocid. Others more generally widespread are the Singer, *Cicada bermudiana* Verrill, the Green Cedar Berry Bug, *Banasa euchlora* Stal. and the Grey Hopper, *Ormenis* sp. The larvae of the boring beetles, *Oeme linearis* Harris and *Leptostylus praemorsus* F., tunnel close under the bark in wounds in the trunk or branches and in lumber stored in the woodpile. They are the first to attack those portions of the tree which die back as a result of excessive shade from competing vegetation like Fiddlewood and Allspice and they thus pave the way for invasion by the dry wood termite and the red rot fungus (described below).

By far the most important insect pest revealed by the survey is the dry-wood termite, *Kalotermes castaneus* Burm (?). The serious nature and extent of this one insect's ravages in the Colony must be emphasised. Not only have over 40% of the cedars examined borne evidence of attack, but an inspection of timber used in the construction of barns, sheds, fences,

gates and posts as well as in the interior of houses, public buildings and business premises, has shown without doubt that these insects are the major pests of wood in the Islands.

No worked wood has yet been found in Bermuda which does not show susceptibility to invasion. Oak is very readily destroyed. Maple, Canadian Spruce, Bermuda Cedar, Mahogany and Birch are all commonly attacked while good Pitch Pine is more resistant. Other types of trees and shrubs found harbouring this pest include Fiddlewood, *Citharexylum spinosum* L., Avocado, *Persea gratissima* Gaertn., Pride of India, *Melia Azedarach* L., Lemon, *Citrus limonum* Osbeck, Trumpet-flower, *Tecoma stans* (L.) Juss., Bay Grape, *Coccolobis uvifera* (L.) Jacq., Tamarisk, *Tamarix gallica* L., Oleander, *Nerium Oleander* L., Common Hibiscus, *Hibiscus Rosa-sinensis* L., and Palmetto, *Sabal bermudana* Bailey. Attack on trees invariably starts at a wound or an unpruned dead branch, and very commonly in the wood exposed by the stripping of the bark. Unfortunately this type of damage is only too common in Bermuda and fully three-quarters of the trees examined bore evidences of damage in the form of wounds, which could be directly attributed either to man himself or to his domesticated animals, horses, cows, goats and rabbits.

Once the termites gain an entrance, they begin their ceaseless tunnelling activities and eventually hollow out the entire tree. The attack may also start from a damaged root causing an invasion to spread from below upwards. There are consequently large numbers of hollow cedars to be found in these Islands, which not only constitute a considerable economic loss to the Colony but a very real menace as well in the event of a hurricane. Although the presence of the "white ants" or "borers" in Bermudian houses and furniture has been known for many years, their economic significance has not heretofore been fully realised. This has no doubt been largely due to the insidious nature of their attack.

Fungal Diseases. Second in importance to the termite damage is the presence of a wound parasite which appears identical with the fungus causing Red Rot or Pecky Cedar on the Virginian Red Cedar, *J. virginiana* L., described by H. von Schrenk in 1900 as a form of *Polyporus carneus* Auct. Amer. (*Trametes carnea* Weir?). The only previous record of this fungus in Bermuda is that by v. Schrenk. Specimens of diseased wood were sent to the Forest Products Research Laboratory, Princes Risborough, England, where the fungus was isolated. The culture however was not found to be typical of this species. Within recent months, fructifications have been obtained from diseased trees which may help to supply more definite information on the systematic position of the fungus.

The fungus gains an entrance to the tree in a manner similar to the termite, through an old wound, and spreads in both longitudinal and radial directions in the heart wood in the form of white papery sheets which turn a dark buff colour with age. The disease is characterised by the formation of pockets, brown in colour and the infected wood reveals the tendency shown by many dry rot fungi, to crack at right angles to the grain of the wood. As a result, the heart wood is ultimately reduced to the form of small cubes adhering to the walls of the pockets. The line of demarcation between the brown diseased wood and the healthy heart-wood is very sharp. Red Rot has been observed on trees of all ages in Bermuda from 50 to 250 years old and appears to be more frequent on old trees which

have been left standing too long before felling. As in the case of termite damage, the tree loses its commercial value and is readily blown down in high winds which are withstood by healthy trees.

Another important fungus responsible for a considerable amount of damage is the cedar rust, *Gymnosporangium bermudianum* (Farl.) Earle, which causes the formation of small rounded galls on the twigs. These are at first deep red in colour and later turn dark brown with death resulting in those portions of the twig distal to the point of infection. Two other fungi have been isolated from blighted foliage, one *Pestalozzia funerea* Desm., and the other a species of *Phomopsis*. The pathogenicity of both is at present under observation. A fungus which also requires further study is *Pitya Cupressi* (Batsch) Rehm. The following species appear to be saprophytic, *Hypocrea patella* C. & P., *Pleurotus niduliformis* Murrill., *Sarcoscypha minuscula* Boud. & Torrend., *Polystictus pinsitus* (Fr.) Cooke, and *Coriolus sericeohirsutus* (Klotsch) Murrill.

Competing Vegetation. Equally important as the insects and fungi found attacking the cedars, are the higher plants which are growing in competition with them. Of these, the Fiddlewood, *Citharexylum spinosum* L., is by far the most serious in its effects. Introduced in 1830, it has since spread with great rapidity throughout the Islands at the expense of the Cedars, especially in Hamilton and Paget parishes. Another fatal introduction was that of Jasmine, *Jasminum simplicifolium* Forst. in 1840, which is now a pernicious weed and has completely ousted and practically destroyed the native flora in the Walsingham district. Other harmful vines belonging to the Morning Glory family such as *Turbina corymbosa* (L.) Raf., have also been recorded killing the trees. Allspice, *Pimenta officinalis* Lindl. is another tree which has been allowed to spread with fatal results, particularly in Warwick Parish. Observations made during the past five years indicate that the affected area has increased considerably. There is every likelihood that both the Fiddlewood and Allspice will continue to spread with disastrous consequences to the endemic Cedar, unless energetic steps are immediately taken to combat them by landowners on their properties.

Remedial Measures Recommended. In most Colonies, the Government has some control of the vegetation covering the hill-tops. These protected areas or Forest Reserves are recognised as a necessary precaution against soil erosion and inadequate rainfall. Under the conditions existing at present in Bermuda, most of this land is privately owned and it rests entirely with the land-owners as to whether or no they manage the trees on their estates in a scientific way. Before any improvement in the general condition of the Cedars can be expected, the trees must be looked at from a different angle than hitherto. In view of its usefulness as a windbreak and its value as timber the tree has every right to be regarded as a valuable forest crop and should be treated as such. Instead of allowing the young trees to spring up in a haphazard fashion in competition with one another and harmful vegetation, they should be planted out in an orderly manner from seedlings raised in a nursery. Such a nursery has recently been started at the Agricultural Station with the object of providing young trees to reforest bare areas as well as supplies for old plantations. In addition, a model cedar plantation was established at Orange Grove, Smith's Parish, through the kindness of Mr. William Zuill, M.C.P. After the trees are established, some provision must be made for their future care, and the formation of Forest Guards whose duties would be the proper care of trees

and ornamental shrubs is very desirable. A start in this direction has already been made through the kind offices of the Officer Commanding the Royal Engineers.

There are two main recommendations to be made at present for the improvement of the condition of the cedars. First of these is the application of thinning, pruning and tree surgical methods. Trees which are overcrowded and interfering with one another, or are diseased or deformed, should be removed to give room for the remainder to attain perfect growth and symmetry. In addition to sanitary measures which include the destruction of all diseased material, every reasonable precaution should be taken to prevent unnecessary injury to the trees, since it is only by the prevention of wounds that the injury caused by both dry-wood termite and red rot fungus can be controlled. An important aspect of pruning and thinning is the increased ventilation obtained which reduces the relative humidity and the incidence of fungi attacking the foliage. Secondly, cedars in defoliated areas should be assisted in their recovery by light dressings of a complete fertiliser containing Nitrogen, plenty of Phosphate and a little Potash. Manurial experiments along these lines are at present being made.

OBSERVATIONS ON THE ONION THRIPS, *Thrips tabaci* Linde.

The first disease to be investigated in Bermuda was Onion Blight, *Peronospora destructor* (Berk.) Caspary, in 1887 by (Sir) Arthur E. Shipley. Among the insect pests recorded, the presence of thrips in very limited numbers was mentioned. Today however they are the major pest affecting this crop in Bermuda. This was shown by counts of larvae at intervals of five days on samples made during the period April 3rd to May 3rd, on five varieties of onion growing at the Station, which are summarised in Table IV.

TABLE IV.

Showing number of Thrips larvae per plant at intervals of 5 days.

Counts of Larvae.

Variety	1st.	2nd.	3rd.	4th.	5th.	6th.	7th.	*Average*
Australian Yellow	27.2	33.8	41.4	64.2	98.0	51.8	—	52.73
Yellow Bermuda ...	35.0	68.4	55.4	83.0	112.6	58.8	29.6	52.20
Sutton's Red Globe	68.4	43.0	36.2	89.6	110.0	57.0	—	50.70
Early Spanish	25.6	43.6	56.0	58.4	54.2	37.8	—	45.93
Sutton's A.1.	20.2	13.6	16.6	12.8	25.8	—	—	14.83
Average	35.3	40.5	41.1	61.6	80.1	51.4		

It will be observed that the larval population rose steadily during April, reaching a peak between the 4th and 5th counts. The striking drop in numbers taken on the variety Sutton's A.1., was found to be correlated with poor growth, and the small number of leaves produced. There was a steady decrease in the thrips population during May due to a variety of factors among which may be mentioned the heavy rainfall on May 9th, a rise in temperature, increase in the numbers of the predator larvae of hover-flies, *Mesogramma marginata* Say. and dying back brought about by Blight, *Peronospora destructor*, and natural maturity.

Various chemical treatments have been tried against this pest. A weak solution of Clensel and Black-Leaf-40 in which seedlings were immersed prior to planting out in February was found to act as a temporary check. Applications of Nicotine dust were also effective for a short period, but were not satisfactory as an economic method of control. Arrangements are being made at the present time for the introduction of *Dasyscapus parvipennis* Gahan from Trinidad in an attempt to control the Thrips by biological means.

OFFICE WORK.

The office work included correspondence on plant pathological matters, the writing of monthly and special reports and articles for the monthly Agricultural Bulletin, and occasionally for the Press. The library was kept in good order, journals and reprints reviewed, and those of local interest indexed as soon as possible after their arrival. A preliminary check list of diseases of economic plants was also prepared. The laboratory equipment was maintained in good order and the addition of apparatus made as funds permitted. Laboratory facilities were extended to the Staff of the King Edward Hospital for a short period. Mr. Jack Osborn, an undergraduate of Cornell University, gave valuable assistance in both field and laboratory work for three months during the summer.

ADVISORY WORK.

Advice on the control of diseases and pests was given to farmers and gardeners throughout the year. The total number of lectures delivered on pathological matters was fourteen and included addresses to Schools, Clubs, Farmers' Meetings, Arbor Societies, Government Departments and Public Utility Companies. In addition, exhibitions were staged at the Sandys Flower Show and at the Agricultural Station together with practical demonstrations in disease control. An attempt was made to stimulate a greater interest in the care of trees by means of an exhibition arranged at the Agricultural Station in which were shown some of the more important diseases and pests of cedars together with the methods advocated for their control.

INSPECTION SERVICES.

Lily Inspection.—The first inspection of lily fields was carried out between January 19th — 22nd, and the second between March 3rd — 6th; and in cases where it was thought desirable, a third inspection was made during April or May.

Out of a total of 45 fields inspected, 41 passed the final inspection, giving an area of 4,557 sq. rods or 28.5 acres, an increase of 317 sq. rods over the area recorded for last year. The majority of the fields examined showed a high standard of freedom from disease and only four small fields were condemned on account of rosette or "yellow flat" disease.

Inspection of Plant Importations.—During the year I inspected 298 packages of imported plants and bulbs. Of these 263 were passed at the time of inspection, while 15 were passed after treatment with hydrocyanic gas. In 20 cases, plants or bulbs were confiscated and destroyed. These included citrus trees from a prohibited area; and lily and narcissus bulbs imported contrary to Bye-Laws.

Inspection of Plant Exportations.—The number of consignments of plants and bulbs examined and certified as free from disease previous to their being exported was 126. The packing-sheds were visited during the packing season.

Inspection of Vegetable Seed.—The celery seed imported from the United States was free from *Septoria* infection, with the exception of one sample of Golden Phenomenal which had a 2% infection. This was treated with formalin before distribution. Seed from France was satisfactorily free from disease.

SPRAYING SERVICES.

The two motor-sprayers were maintained in working order throughout the year, one being kept at Southampton and the other at the Agricultural Station. They were employed together for a total period of 588 working hours, chiefly for spraying potatoes, tomatoes, celery, lilies, oleanders and other ornamental shrubs. Hand dusting machines were employed on potatoes, tomatoes and ornamental plants in the Station grounds. Supplies of Oil Emulsion were maintained and distributed when required for the control of scale insects.

DISEASES AND PESTS OBSERVED DURING THE YEAR.

THE WEATHER. The weather at the beginning of the year was dry and temperatures were higher than normal. As a result the Triumph potato crop was singularly free from *Phytophthora* blight and this disease did not really become noticeable until early in March on the Cobblers. Heavy winds on April 1st destroyed a considerable proportion of the tomato and potato crops and blighted the foliage of Cedars, Hibiscus and Oleander wind-breaks. Several days of heavy rain during this month acted as a prelude to the appearance of *Septoria* blight on celery, which became severe towards the middle of the month particularly in pond-land subject to flooding. During the summer months, which were exceptionally dry, all forms of plant life suffered from drought. By November however, a return to normal weather conditions was experienced, and the fall planting of Triumphs made a good start. *Phytophthora* blight reappeared, however, towards the end of December.

ON ECONOMIC PLANTS.

Bananas. Cigar End disease, *Stachylidium theobromae* Turc., was recorded for the first time from Bermuda by Dr. C. W. Wardlaw, at Bailey's Bay, on Cavendish bananas. Attack by thrips, *Heliothrips femoralis* Reuter, on fruit, was observed during March on some badly neglected plants near Pembroke Marsh, which were overrun by Morning Glory vines, *Ipomoea cathartica* Poir. The source of infection was traced to this vine.

Beans. Mildew, *Erysiphe polygoni* D. C. was widespread on String Beans during January.

Beets. The fireworm, *Hymenia fascialis* Cram., took its usual toll of this crop during the autumn months.

Cabbage. Black Rot, *Bacterium campestre* (Pam.) EFS was abundant on old cabbage and broccoli during February.

Carrots. Leaf Blight, *Macrosporium carotae* E. & L. was severe during May. In view of the losses caused to the summer crop by this fungus, routine spraying is recommended.

Celery. *Septoria* blight did not appear until the middle of May. The over-wintering of this fungus in the soil was experimentally confirmed. There was little Black Heart recorded during the year.

Citrus. Purple Scale, *Lepidosaphes beckii* Newm., continued to menace trees which were not regularly sprayed with Oil Emulsion. Sweet Orange fruits infested with Mediterranean Fruit fly, *Ceratitis capitata* Wied., were obtained during March, but no trace of parasites found. This accords with previous records of larvae taken from citrus. The incidence of Fruit fly was not high this year.

Cucumber. A severe infestation of the Root-knot nematode, *Heterodera marioni* (Cornu) Goodey was found in the houses of one of the largest growers of cucumbers under glass in Bermuda. Advice was given on control measures. This nematode was also recorded on carrots and celery in the field.

Lilies Among virus diseases, rosette or "yellow flat" was low in incidence and was kept well under control by roguing. Mosaic diseases were more in evidence. "Twist", a disease of uncertain origin, bears a superficial resemblance in leaf symptoms with those caused by viruses of the mosaic type, but differs markedly from that group. The disease is not propagated by vegetative means nor is it sap transmissable. Leaf spot, *Botrytis elliptica* (Berk.) Wright, was prevalent during April. A species of *Vermicularia* was isolated from dead leaves and from lesions in the bulb scales. Larvae of the hover-fly *Allograpta obliqua* Say. were found preying in large numbers on the insect vector of rosette disease, *Aphis gossypii* Glov., during April.

Onions. Onion blight, *Peronospora destructor* (Berk.) Caspary, became very prevalent after heavy rain during the middle of April. *Colletotrichum circinans* (Berk.) Vogl. was associated with a storage rot of onions caused apparently by *Bacillus carotovorous* Jones. Larvae of the hover-fly, *Mesogramma marginata* Say., exercised a beneficial effect in the control of larvae of the onion thrips, *Thrips tabaci* Linde.

Potatoes. Crops generally maintained a high standard of freedom from virus diseases. Rhizoctoniose, *Corticium vagum* was recorded in small quantities on English Royal Kidney tubers at harvesting. Complaints were again received this year from farmers with regard to the Bliss Triumph seed imported from Long Island. The trouble was identified as Stem End rot, *Fusarium oxysporum* Schl.

Tomatoes. Wilt disease, *Fusarium lycopersici* Sacc. was severe in fields at Knapton Hill as a result of continuous cropping without rotation. A species of *Phytophthora* was isolated from green tomato fruits during the months of January and June from varieties Marglobe, Pritchard and Break O'Day. The fungus caused brown spots on the fruit, the tissue remaining quite firm. Growth was rapid on Oatmeal agar at 30°C., and the species was provisionally assigned to the *P. palmivora* Butler group.

Watermelon. Anthracnose, *Colletotrichum lagenarium* (Pass.) E. & H., was troublesome on St. David's Island during May and was accompanied by hopper-burn caused by *Empoasca fabae* Harr.

ON OTHER PLANTS.

Ants. The use of "Tanglefoot" grease bands effectively checked the activities of *Pheidole megacephala* F. in transmitting the various scale insects and aphids attacking Crotons, Hibiscus, Oleander and Palmettoes.

Gardenias. Several attempts have been made to grow imported garden varieties of Gardenias with little success. The leaves usually exhibit severe chlorosis and the whole plant looks very poor. Various special fertilizers are on trial at the present time.

Gladiolus. A severe attack by thrips, *Taeniothrips gladioli* Moulton, was observed in Paget during April.

Juniper. The cedar scale, *Chrysomphalus agavis* Ths. & Ckll. was recorded on a prostrate form of Chinese Juniper *J. chinensis* L., at Tucker's Town in March.

Snapdragon. The appearance of Rust, *Puccinia antirrhini* Dietel & Holway, was first noted towards the end of April when it was too late to do any appreciable damage. The control of *Sclerotinia* on this and other garden annuals was successfully achieved by watering flower beds previous to planting with a solution of Formalin, diluted one pint in ten gallons of water, and applied at the rate of half a gallon per square foot of soil.

ADDITIONS TO RECORDS.

There was little time for systematic collection during the year but the following fungi were recorded in addition to *Stachylidium theobromae* Turc. on Cavendish Bananas;—

Lenzites sepiaria Fr., very destructive to worked wood in the Colony.

Leptodermella opuntiae n. sp., described by Dodge in Mycologia *30:* 82-96, 1938, from Prickly Pear, *Opuntia Dillenii* (Ker.) Haw.

Simblum sphaerocephalum Schlecht., an interesting Gasteromycete found growing on soil at the Agricultural Station.

Respectfully submitted,

J. M. WATERSTON,

Plant Pathologist.

30th March, 1938.

Report of the Agricultural Assistant for the Year, 1937.

The Director of Agriculture,

I have the honour to submit my report for 1937.

I was absent from the Colony from 7th April to 26th July being stationed in Canada as Marketing Officer. During the remainder of the year I was engaged in routine work at the Agricultural Station and advisory work on farms. Much time was devoted to the encouragement of poultry-keeping, and prior to the appointment of the Horticulturist, I devoted considerable time to horticultural work. At the request of the Bermuda Garden Club I took charge of the arrangements for the Annual Garden Competition in Paget Parish.

OBSERVATIONS ON FARMING CONDITIONS.

Marked changes have occurred in farming practices during recent years. Those changes are largely the result of the diminishing opportunities for marketing vegetables abroad and more intensive competition in the local market. At the present time few farmers gain their livelihood entirely from the soil. Many farmers who formerly farmed land exclusively for a living have been forced to find other part-time employment to supplement their incomes. Some of these have been able to find employment in connection with building operations by quarrying stone and by performing excavating work and by trucking building supplies. While employment of this kind has enabled many men to hold on to their farms the land cultivated has dwindled from year to year. Along with the curtailment of planting cultural methods have deteriorated and crop rotation has been neglected. It is not uncommon to see two crops of potatoes follow each other in the same piece of ground and a crop of tomatoes planted between the rows before the second crop is reaped. A few farmers who formerly catered to the export market have directed their efforts to supplying the local market with a large variety of vegetables, eggs and milk and undoubtedly it has had a beneficial effect on increasing local consumption. Unfortunately however local marketing lacks organisation to afford the farmer the full benefits he deserves. The Farmers Market in Hamilton has provided a considerable outlet for farm produce but lack of facilities to carry over seasonal surpluses has tended to encourage price cutting and credit selling on a large scale much to the detriment of the farmers.

POULTRY IMPROVEMENT WORK. During the latter part of the year efforts were made to revive interest in Poultry raising. In November the Bermuda Poultry Association was successfuly revived and a fair number of members were enrolled. The potentialities of poultry raising on the Island are considerable. It would be a profitable effort to be able to produce all the eggs and table poultry that the home market can consume. The Department can render a useful service in building up a successful poultry industry. A poultry project covering a period of 3 or 4 years should produce worthwhile results. It should be made one of the major projects of the Department and a special appropriation for this purpose should be considered.

MARKETING OF EXPORT VEGETABLES. The prices realised for Bermuda vegetables in the Canadian markets were higher than those obtained the year before with the exception of celery and potatoes. Unfortunately, however, the crop marketed was little more than half that of the previous season and approximately 47 per cent of the average of the preceding 5 years. The improved marketing conditions compared with those of the previous year reflected advantageously on the returns to the growers; because of the better movement cold storage and reconditioning charges were largely eliminated and consequently the nett returns were substantially enhanced. The farm value of the crop was only £4,000 less than the previous year for a crop almost twice as large. It is difficult to determine the effects of the United States-Canada Trade Agreement on the sale of Bermuda vegetables in Canada during the two seasons the agreement has been in force because marketing conditions were not by any means normal. However, the gradual elimination of protective tariffs for our vegetables in the Canadian market such as has been the case since the United States-Canada Trade Agreement became effective two years ago has seriously jeopardised our opportunities for profitable marketing. There is a feeling among the trade in Canada that the protection of 2 cents a lb. afforded Empire Countries under the Ottawa Agreement should be abolished, or radically reduced. This point of view will undoubtedly be stressed in any future negotiations for trade between the United States and Canada. The outlook in the export market is not at all encouraging, the gradual elimination of protective tariff for our vegetables is driving us out of the market, and marketing conditions in the United States are such that even with lowered tariffs for our vegetables we cannot hope to obtain remunerative prices there.

Observations on Shipments.

Beets. Satisfactory prices were returned for beets. No serious trouble was found in any of the shipments, but the tendency to ship overgrown roots still exists. The demand for beets before the beginning of May is not usually good, but as summer approaches their use for salads increases and by that time stored domestic stock of good quality are not available. Although only bunched beets are imported into Canada from the United States the objection to our cut beets does not appear to be as strong as formerly especially late in the season. I believe it would be worthwhile to encourage a small increase of beet plantings for marketing in May and June.

Cabbage. Our experience in marketing cabbage in Canada over a number of years has been disappointing. Our cabbage is not sufficiently uniform in grade and quality to compete with imports from the United States and its keeping qualities leave much to be desired. Until the quality is improved, the export of cabbage should not be encouraged.

Carrots. This season set a record for prices in Canada. The lowest was $1.40 and the highest $3.25 per bushel crate both obtained in Montreal. Some of the prices were abnormally high, and were obtained by using one market against the other when supplies were irregular and short. Two factors worked in our favour, the United States crop was reduced due to frost injury, and from the end of May onwards shipments that came forward were difficult to market due to rotting caused by the fungus *Sclerotinia sclerotiorum*. As to the quality of our own carrots this season, most of the shipments showed very little decay on arrival and the rapidity with which

they went into consumption obviated the usual trouble in this respect. The best prices were obtained between 1st June and 15th July, which is usually the most advantageous time to sell our carrots in Canada, but our farmers are seldom able to time their plantings to catch the market in its best stride.

Celery The quality of this season's crop was as good and possibly a little better than the average of several seasons but the returns were disappointing. Bermuda celery has always been looked upon with disfavour by the Canadian trade because of lack of uniformity in grading and the rapidity with which it deteriorates during the process of marketing. For this reason it has been impossible to establish a steady demand for it. The chain stores which handle about 75% of the importations of celery have taken little Bermuda celery for several years because it does not meet their requirements. The remaining outlet of sales is through independent stores and peddlers. The peddler does not as a rule handle first class produce but picks up commodities which require reconditioning prior to sale to the retail trade, and unfortunately the bulk of our celery has to be marketed in this way. Until the troubles which are affecting the sales of our celery are corrected we cannot hope to secure profitable prices except on occasions when supplies from elsewhere are not available. As long as the grading of celery is left to the farmers to perform individually there can be no uniformity of grading. But the lack of uniformity in grading is a minor factor affecting the sale of our celery compared with the rapidity which it becomes unsaleable through deterioration in quality, for which Late Blight and Sclerotinia Rot are to a considerable extent responsible.

Onions. Shipments of onions reached the lowest level since regular trade was commenced with Canada in 1930. The prices realised in the Maritime Markets were fairly remunerative to the shippers but had the volume of shipments been larger prices would have been much lower. During the last eight seasons in which we have shipped onions to Canada there have been few seasons when their sale has been profitable to farmers.

Potatoes. Although the potato market was not as receptive as the previous season which was a season of high prices, the farmers received satisfactory returns because the shipments were well timed to meet the best demand. Jamaica potatoes were sold in Montreal during March and April but by the time our first large shipment came forward Jamaica's supplies were dropping off and ours came in nicely to fill the gap until South Carolina came on the market.

Tomatoes. The quality of the tomato shipments compared favourably with other years. Unfortunately the crop was late and the time in which the crop could be marketed before domestic supplies became available was very short. Considerable difficulty was experienced in disposing of some of the shipments, particularly the shipment of 9,526 crates ex Lady Rodney 30th June.

One shipment of 800 crates was received via New York by Queen of Bermuda 4th July. This shipment was consigned to Montreal but because of the poor outlook in Montreal it was diverted to Moncton, N.B. It sold at an average price of $1.61 per crate and it netted the growers an average of 91¢ per crate.

For several years I have harped on the folly of shipping small unwrapped tomatoes. There is no sale for them through the regular channels of trade, and it is only occasionally they can be sold at remunerative prices.

But that is not the worst feature, their sale at low prices often depreciates the sale of the larger sizes. It is difficult to convince the grower on the point because the Account Sales reveal only the profit or loss on individual items as sold, and as long as the returns for small tomatoes exceed the charges on them the grower thinks that his efforts have not been in vain.

By insisting on shipping small unwrapped tomatoes we have definitely created a prejudice against our tomatoes in Canada, and I am convinced that this shortsighted policy has deprived the growers of greater benefits for their tomatoes for several years.

Transportation Service by C. N. S. Steamers.

The condition of the shipments on arrival in Canada was fairly satisfactory throughout the season, although some shipments carried better than others. Every effort was made to find out the cause of the trouble whenever a shipment arrived in poor marketable condition and I am satisfied the Steamship Company exercised every effort to land the produce in Canada in the best possible condition. When Mr. W. J. Thompson, Freight Traffic Manager, visited Bermuda in April I called his attention to the necessity of providing air circulating fans in two cold storage chambers on the Lady Rodney and also the two corresponding chambers in the Lady Somers. On my arrival in Montreal about the middle of April I approached the Freight-Traffic Manager on the subject again and I discussed the matter with the General Manager and with the Supervising Engineer, and I was assured that the matter would receive immediate attention. When I left Montreal on 21st July the fans had not been installed in any of the chambers referred to. The steamship company may have a good reason for not installing these fans, but I am convinced the lack of air circulation in these chambers does not permit the best possible conditions for carrying our vegetables.

Shipments to Canada via New York.

The shipments made through New York arrived in Montreal in much the same condition as shipments that came on Canadian National Steamers via St. John N.B. In both instances there was more crate breakages and bruising caused by the double handling than was noticed in direct shipments to Montreal, but shipments via New York have the advantage of quicker transit time. This will sometimes be useful in obtaining better distribution for our produce and it will be advantageous to the growers to use this route occasionally between sailings of C.N.S. ships to prevent losses from over-maturity especially in the case of celery.

Respectfully submitted,

W. R. EVANS,

Agricultural Assistant.

4th April, 1938.

Report of the Horticulturist, 1937.

For the Period 26th October to 31st December.

The Director of Agriculture,

I have the honour to submit the following report on horticultural work accomplished from the time of my arrival in the Colony until the 31st December.

Station Grounds. Throughout the months of November and December the Station Grounds were maintained in a satisfactory condition, and during December the Station as a whole was remarkably free from weeds.

Although time would not allow any large scale alterations in the design and general arrangement of trees, and shrubs, a few minor changes were practicable. Newly planted trees and shrubs show promise of having become established in the new quarters and the three new beds of shrubs at the North East corner of the Southbank should prove to be an attractive addition.

Seasonable flowering annuals as in previous years have been used extensively in all vacant beds and borders to provide a display of colour during the coming Spring and early Summer.

Glass and Slat Houses. The condition of the plants in the glass and slat houses is disappointing and is mainly due to a great deal of over crowding which prevailed throughout the Summer and early Autumn. This state however has been alleviated to a certain extent by planting batches of young plants in the nursery and eliminating all unnecessary stock. With attention to cultural details it is hoped that in the coming year many improvements will be shown in these houses.

Nursery. Other than general routine work the nursery received little attention, as it is necessary to reorganise this section in order that the space may be used as economically as possible.

Orchard. A collection of ten varieties of grape vines were planted in the orchard and a few citrus trees. These grapes are varieties grown in the Azores, and the object of this trial is to discover whether these varieties will succeed in Bermuda.

Experimental work on Propagation. An experiment with plant Hormones has been started.

Cuttings of the following plants were treated:

Bougainvillea lateritia, Cassia floribunda, Cinnamomum Camphora, Acacia longifolia, Brunfelsia americana, Sabinea cardinalis, Lagerstroemia indica, Pittosporum Tobira, Thunbergia erecta, Elaeodendron laneanum, Abelia grandiflora.

At the time of reporting it is not possible to do more than mention the experiment.

Plant Distribution. Numerous trees and shrubs have been distributed to various public bodies for roadside and other plantings. In addition plants were presented to bazaars and others sold at nominal prices.

Coronation Plantings. The Department during the year raised a large quantity of *Spathodea campanulata* ("African Tulip Tree") now known in Bermuda as the "Coronation Tree", and distributed these throughout the Colony to public and private gardens, to be planted in Commemoration of the Coronation of Their Majesties King George VI and Queen Elizabeth. Many of these trees were actually planted on Coronation Day, May 12th. It is pleasing to note that most of the trees are now well established and in years to come will be a very attractive and interesting feature of the Colony.

Several of the Parishes due to the work of the Garden Clubs and Arbor Societies have set aside a portion of land as the "Coronation Plot" and have planted these with flowering trees and shrubs with the *Spathodea campanulata* as the central feature.

Advisory Visits. Visits have been made to a number of the public and private gardens and nurseries mainly to become acquainted with the district, to study the type of Horticulture practised and the plants most suitable to Bermuda. At the same time my advice has been sought by several private property owners on Landscape gardening.

Demonstration. At the request of the Secretary of the Sandys Garden Club, and with the assistance of the Plant Pathologist, a demonstration on "Pruning and the Use of Pruning Tools" was given to the members and their gardeners on 10th December. Much interest and enthusiasm was displayed at this demonstration, and it is felt that some very useful work could be done by further demonstrations of this kind.

Labelling. Adequate labelling of all trees and shrubs and other plants throughout the Station is essential. At present many of the labels have been lost or are quite illegible. However the work of re-labelling has been commenced and in due course it is hoped that all plants will have their names attached.

Office Work. Office routine work has been given the necessary attention, reports submitted monthly and the identification of plants undertaken for visitors.

Noteworthy Plants. A very graceful shrub of outstanding beauty worthy of greater popularity is *Holmskioldia sanguinea* "Chinese Hat Plant". This shrub blooms very profusely during the Winter months, and plants happily established may be seen at the Agricultural Station in the shrub bed at the foot of the main lawn.

A Guide to the Agricultural Station. The proposed publication of the "Guide to the Agricultural Station" compiled by the present Director of Agriculture will prove to be exceptionally valuable to persons visiting the Station. This Guide contains all the most interesting plants in cultivation at the Station and by its aid strangers will be able to locate and determine the desired specimen very easily.

Observations. Bermuda like other parts of the World presents many problems in Horticulture. Possibly the greatest difficulty is the

extremely shallow soil in most parts of the Island, limiting considerably the activities of the Landscape Gardener.

The soil has been formed entirely from the weathering and disintegration of the aeolian limestone of which the rocks of Bermuda consist, leaving a soil that is calcareous throughout. This factor alone prevents the introduction of plants belonging to the families of *Ericaceae, Protaceae* and others resenting Alkaline conditions. In spite of this however the climatic conditions are favourable for the growth of a large selection of tropical and sub-tropical plants in the sheltered parts of the Island.

With these facts in mind the gardens of Bermuda can be made quite attractive by the careful use and spacing of the plants already available, and members of the Department are always ready to give advice on suitable arrangements and plantings.

Acknowledgments. In conclusion, I would like to record my grateful appreciation to all the members of the Department for the very cordial reception when I arrived in the Colony, and for the valuable assistance since that date.

Respectfully submitted,

G. R. GROVES,

Horticulturist

19th January, 1938.

Report of the Inspector of Produce, 1937.

The Director of Agriculture,

I have the honour to submit my report for the year 1937.

GOVERNMENT PACKING OF VEGETABLES.

No. 1 Packing Shed was opened during January for the packing of Kidney potatoes for shipment to England, and remained open from that date for the packing of potatoes and other vegetables for the remainder of the season. The Southampton Packing Shed was opened at the end of April and remained open until 19th June under the supervision of Mr. A. W. Fowle, Sub-Inspector of Produce. Potatoes, onions, cabbage, and carrots were the chief vegetables packed there. No. 2 Packing House at the Agricultural Station was not opened this year due to the fact that it was found unnecessary as the crop of tomatoes amounted to practically half of that of the previous year. Packing House No. 1 was finally closed for the season on July 16th.

Quantities of vegetables packed. The following table shows the quantities of Government-packed and Farm-packed vegetables:

Quantities of Vegetables shipped to Canada in 1937.

	Government-packed.	Farm-packed
Beans (crates)	34	—
Beets "	221	481
Cabbage "	701	659
Carrots "	5,302	5,663
Celery "	—	12,042
Cucumbers "	91	—
Onions "	1,101	468
Potatoes "	2,946	1,813
Potatoes (barrels)	—	10
Parsley (crates)	—	74
Spinach "	—	149
Tomatoes "	26,765	1,627
Miscellaneous	6	—

Quantities of Vegetables shipped to U. S. A. in 1937.

	Government-packed	Farm-packed
Kale (crates)	—	1,584
Potatoes "	193	1,037
Potatoes (barrels)	—	3,817
Lily Buds	—	13,526

Quantities of Vegetables shipped to England in 1937.

	Government-packed	Farm-packed
Potatoes (crates)	1,293	—

INSPECTION OF FARM-PACKED VEGETABLES.

Mr. C. V. S. Early, Assistant Inspector of Produce, was on duty at the dock during the season, and Mr. T. J. Outerbridge, Sub-Inspector was on duty when needed.

COMMENTS ON VEGETABLES SHIPPED.

Farm-Packed to New York:

Potatoes. The Triumph crop was small but generally in good condition. Garnets cropped well but the majority were sold locally.

Kale. Condition of Kale was very good. Shipments ended about the middle of May.

Farm-Packed to Canada:

Beets and Carrots. These were not too good owing to the fact that they were affected by blight and kept in the ground too long by most farmers.

Celery. The early celery was very good, but late celery showed a great deal of blight and pink rot. Practically no black heart was seen throughout the season.

Cucumbers. Cucumbers were in a poor condition and the majority overgrown.

Cabbage. Cabbage was poor and most of it reaped immature.

Onions. Onion seed was poor and mixed with white and red. Crop not up to its usual standard.

Parsley. Very good but little shipped.

Potatoes. Cobblers cropped very little and many showed black eye and scab.

Tomatoes. 1,067 crates were packed by the Hill Company, their packing continuing to show improvement.

Produce Rejected at Dock.

Beets	111	crates
Carrots	280	"
Cabbage	62	"
Celery	825	"
Kale	57	"
Onion	110	"
Potatoes	57	barrels
Potatoes	103	crates
Total	1,605	packages

The majority was picked over but several lots were condemned outright.

Appeals. During this season there were several appeals. In all cases referees were called in and it was decided by them to ship the vegetables under a different mark. In the opinion of the Inspectors the clause in the Agriculture Act regarding referees should be obliterated.

Supervision of Chill-Rooms. These were inspected for every shipment by Asst. Inspector Early, the Sub-Inspectors and myself. Stowage was found to be very satisfactory, and percentage of breakage small.

SEED POTATOES IMPORTED.

From 1st January to 31st March:

Triumphs from Canada	327	barrels
Cobblers " "	327	"
Cobblers " "	30	bags
Katahdins " "	41	barrels
Green Mountain "	20	barrels

From 1st August to 31st December:

Triumphs from Long Island	80	barrels
" " Canada	2,748	"
Cobblers " "	1,427	"
" " "	200	bags
Katahdins " "	100	barrels
Green Mountain "	1	"
Kidney "	142	"
Garnets "	1,032	"

CRATE MATERIAL AND COOPERAGE IMPORTED.

Crate material was inspected on arrival and found to be in good condition. No barrel material or empty barrels were imported this season.

PACKING HOUSE INSPECTION OF LILY BULBS.

Inspection started on 1st of July for bulbs for export. Bulbs cropped well but showed quite a number blown and having basal rot. The licensed exporters showed great care in grading and selection, and packing was good.

FARMERS' MARKET.

All stalls were rented. The market was thoroughly whitewashed, painted and cleaned and is in very good condition. A member of the Department has attended to the opening and closing throughout the year.

OTHER WORK.

I made surveys during the crop season and duly reported on same. At the close of the vegetable packing season I attended to the laying up and lubricating of all grading machinery. I made periodic visits to the three Packing Houses during the summer.

Respectfully submitted,

T. A. HOLLIS,

Inspector of Produce.

17th February, 1938.

Report of the Government Veterinary Officer, 1937.

The Director of Agriculture,

I have the honour to submit my report for the year 1937.

LOCAL OUTBREAK OF INFECTIOUS DISEASES. A severe outbreak of distemper in dogs occurred during and continued since September, confined chiefly to the central parishes, Pembroke having the greatest number of cases. I am advising owners of dogs to have them vaccinated against this disease and many have done so. I hope in this way to combat it.

IMPORTATION OF ANIMALS. The following domestic live stock were imported:

Horses	369	increase of	78
Dairy Cattle	39	decrease of	15
Dogs	291	" "	14
Poultry	20,743	increase of	3,835
Goats	3	same	
Miscellaneous	129	decrease of	399

Almost all the dogs which come into the Islands are brought in by American visitors, and taken back on their return.

In January a puppy arrived without the necessary certificate of health and was quarantined at the Agricultural Station. In March a horse arrived suffering from Strangles or Shipping Fever, which was quarantined at the owner's premises. In August three horses arrived without the necessary certificates and were segregated and subjected to the Ophthalmic Mallein test for glanders. In September a horse arrived suffering from Strangles and was quarantined at the owner's premises.

With regard to these horses which arrived suffering from this malady I wrote to the shipper and the Veterinarian who gave the clean bill of health, and told them that if a horse came again in such a condition I would not let it land, but would send it back. Since then I have not had any more.

In June the Air-ship Service was inaugurated and up to date three dogs have been brought in by this means.

VISITS OF INSPECTION. During the year I made 216 visits of inspection to animal quarters on vessels and 385 visits to various parts of the Island to inspect coolers, inoculate dairy cattle in connection with licences to sell milk and also for the purpose of making tests for contagious abortion in cattle.

TUBERCULIN TEST. Of 1769 cattle subjected to this test 42 reacted. This total shows an increase of 320 in the number tested, and an increase in the number of reactors by 12, as compared with 1936. In addition, four carcases of animals slaughtered by the butcher were condemned on account of tuberculosis.

The cattle in Somerset were again subjected to this test and again no reactors were found, this being the sixth year in which the cattle of Somerset have been free from Tuberculosis. In Paget, Pembroke and Devonshire cattle were subjected to both this test and also the test for contagious abortion.

TEST FOR CONTAGIOUS ABORTION. From 778 cattle subjected to this test the following results were obtained in the various parishes.

Parish.	No. tested	Number showing no agglutination.	No. showing agglutination at a titre of 1/25	1/50	1/125	1/250	1/500	1/1000
Paget	222	197	7	10	3	4	—	1
Pembroke	250	207	11	12	7	8	3	2
Devonshire	244	141	43	26	17	7	5	5
Southampton	28	14	12	—	2	—	—	—
Sandys	12	3	1	5	1	2	—	—
Warwick	22	13	1	6	—	2	—	—

I find that owners of cattle are most helpful with regard to this test, as they realise the importance of knowing whether or not their cattle are infected, and many of those which reacted have been slaughtered. With such co-operation and strict adherence to our regulations regarding imported cattle I feel that the malady can be overcome in time.

CONDITION OF DAIRY STOCK. The general condition shows improvement though the number of scrub bulls has increased. I am glad to say that the Department has now a pure-bred Guernsey bull, and plans to obtain a pure-bred Guernsey cow for the purpose of improving stock throughout the island.

FARMERS' MARKET. This market was visited weekly with the exception of the time I was away on leave. The general conditions remain good.

PRIVATE MARKETS. The coolers of the various private markets were inspected frequently and conditions found to be satisfactory and in some cases to have improved.

CRUELTY TO ANIMALS. Professional evidence was given in 3 cases prosecuted by the Police, a decrease of 5 cases as compared with 1936.

RECORD OF MOVEMENTS. I was absent on leave from 23rd October to 15th November, when I went to the United States on private business.

While there, at the request of the Board of Agriculture I inspected several young, pure-bred Guernsey cows for the Department, of which it is hoped to bring one down shortly.

Respectfully submitted,

C. J. COOPER,
Government Veterinary-Officer.

Pembroke,
31st December, 1937.

Appendix A.

RAINFALL RECORDED AT AGRICULTURAL STATION, 1937.

January	1.05	inches
February	7.71	"
March	4.00	"
April	8.53	"
May	7.24	"
June	7.99	"
July	.95	"
August	1.53	"
September	6.88	"
October	3.71	"
November	5.90	"
December	6.67	"
Total	62.16	inches

RAINFALL FOR LAST FIVE YEARS.

1932	53.32	inches
1933	46.22	"
1934	56.67	"
1935	64.85	"
1936	55.24	"

C. V. S. EARLY,
Station Foreman.

6th January, 1938.

Appendix B.

FINANCIAL STATEMENTS.

(a) EXPENDITURE (Exclusive of Personal Emoluments) for the Year Ended 31st December, 1937.

General Grant.

Appropriated by Act No. 49 of 1936					£1,500	0 0
Labour for experimental plots, lawns, flower-beds, roads, live stock etc.	£1,112	16	0			
Seed Potatoes and other seed	21	18	9			
Prison Labour	5	0	0			
Cartage and Ploughing	3	3	0			
Manure and fertilisers	23	4	1			
Livestock feed, bedding and incidentals	94	11	9			
Repairs and renewals of buildings, tools, etc.	54	9	4			
Purchase of Bee-keeping Apparatus	18	6	9			
Printing	54	5	8			
Contingencies	16	13	9			
Unexpended Balance	95	10	11			
	£1,500	0	0		£1,500	0 0

Inspection Services, Market Investigations and Contingencies.

Appropriated by Act No. 49 of 1936					£ 800	0 0
Inspection of vegetables at dock and at Packing Houses	£	103	16	0		
Representation in Canada		278	13	5		
Advertising in Canada		13	15	8		
Purchase & Advertising of lily bulbs		82	19	2		
Freight on experimental shipments to Canada and England		37	7	11		
Printing in connection with shipping of vegetables		9	4	0		
Cold Storage Investigations		199	16	4		
Subscriptions to periodicals		2	3	0		
Cables		37	4	7		
Unexpended Balance		34	19	11		
	£	800	0	0	£ 800	0 0

Control of Animal Diseases.

Appropriated by Act No. 49 of 1936					£ 300	0 0
Appropriated by Supplementary Grant No. 36 of 1937					50	0 0
Compensation to owners of condemned cattle	£	340	0	0		
Supplies and Contingencies		2	18	6		
Unexpended Balance		7	1	6		
	£	350	0	0	£ 350	0 0

Control of Plant Diseases and Pests.

Appropriated by Act No. 49 of 1936					£	150	0 0
Labour	£	15	3	9			
Fungicides and insecticides		47	14	7			
Repairs to Spraying Machine		3	13	6			
Repairs to Laboratory and Purchase of equipment		59	7	3			
Gasolene, etc.		5	12	4			
Printing		13	10	2			
Subscriptions to periodicals		4	11	1			
Unexpended Balance		...	7	4			
	£	150	0	0	£	150	0 0

Improvement of Livestock.

Appropriated by Act No. 49 of 1936					£	500	0 0
Purchase of Livestock	£	47	2	3			
Purchase of Battery Equipment etc.		90	7	0			
Unexpended Balance		362	10	9			
	£	500	0	0	£	500	0 0

Horticulture.

Appropriated by Act No. 49 of 1936					£	150	0 0
Labour	£	72	7	9			
Repairs and renewals of glass-houses, tools, etc.		21	14	11			
Seeds, bulbs and plants		22	3	7			
Fertilisers, etc.		18	17	0			
Printing		12	8	8			
Subscriptions to periodicals		1	3	9			
Unexpended Balance		1	4	4			
	£	150	0	0	£	150	0 0

Departmental Contingencies.

Appropriated by Act No. 49 of 1936					£	120	0 0
Local Travelling Expenses, Bicycle Allowances, etc.	£	20	15	9			
Stationery and other Office supplies		68	2	2			
Printing		5	5	6			
Foreign Postage		3	0	0			
Repairs to Typewriters		3	3	9			
Lighting and Power		6	9	7			
Telephones		11	12	0			
Subscriptions to periodicals		1	3	1			
Unexpended Balance		...	8	2			
	£	120	0	0	£	120	0 0

Packing House, Services and Contingencies.

Appropriated by Act No. 49 of 1936								£4,000	0 0
Packing House Supplies:									
Nails	£	19	8	2					
Wrappers		133	9	9					
Labels, etc.		37	1	7					
Truck		8	11	9	£	198	11	3	
Labour: Pasting labels, making crates, grading, packing etc.						1,280	16	1	
Labour: Construction						33	6	0	
Electric Current — light and power						26	17	5	
Telephones (2)						5	0	0	
Rental Southampton Packing Site						12	0	0	
Repairs to buildings & machinery						53	10	6	
Cartage of Packed Vegetables						76	12	9	
Cold Storage of Vegetables						161	17	7	
Insurance of Packing Houses						33	12	0	
Printing and Stationery						13	2	9	
Unexpended Balance						2,104	13	8	
					£	4,000	0	0	£4,000 0 0

(b) REIMBURSEMENTS TO GOVERNMENT.

Sale of vegetables								£	85 15 4
vegetable plants									9 2 6
ornamental plants									40 12 7
spraying material									32 1 9
Spray cart									16 0 0
Hire of Rototiller									2 15 0
Seedmen's Licences									1 15 0
Imprest Account: Prison labour									2 13 5
Packing House Receipts:									
Charges for packing, grading, material and labour on crates									631 15 0
Rail freight from Southampton									23 11 10
								£	846 2 5

(c) FARMERS' MARKET.

Balance Brought Forward								£	82 11 4
Received for hire of Stalls									136 8 4
Rental of Market					£	100	0	0	
Lighting						9	16	6	
Cleaning and Painting, Market— Material & labour						18	19	4	
Unexpended balance carried over						90	3	10	
					£	218	19	8	£ 218 19 8

NORA E. HOLLIS,

Clerk, Board of Agriculture.

31st January, 1938.

Appendix C.

DISPOSAL OF PRODUCE, 1937.

Milk and Vegetables to King Edward VII Memorial Hospital valued at	£45	0	0
Vegetables and Plants donated to Bazaars	19	1	0
Plants donated to Arbor Societies, etc.	25	16	0
	£89	17	0

PRISON LABOUR, 1937.

Prisoners present during year .... 148 men days.

C. V. S. EARLY,
Station Foreman.

Appendix D.

LICENSED VETERINARIANS.

R. L. Tucker, D.V.S.
C. J. Cooper, V.S.
J. W. Sutherland, B.V.Sc.

LICENSED SHIPPERS OF PRODUCE.

The following persons or firms are licensed to ship produce under provisions of The Agriculture Act 1930.

A. C. Benevides
J. M. Darrell
Henry Dunkley & Co.
The Hill Co.
O. R. Loblein, Ltd.
Pearman, Watlington & Co.
Manuel F. Simons (kale to United States of America).

LICENSED FARMER-SHIPPERS.

The following persons are licensed under provisions of The Agriculture Act, 1930, to ship produce grown by themselves.

F. A. Hollis
Malcolm Hollis
Gabriel Jacome
M. F. King & Son
M. S. Madeiros
E. J. Moniz
J. De Moura
Bento Olivier & Son
Louis Perreira
E. W. Outerbridge
J. R. Outerbridge
D. C. Robinson
M. F. Simons
P. B. Stephens
J. DaCosta DaSilva
K. A. Wilkinson
L. B. Hollis

LICENSED LILY SHIPPERS.

The following persons or firms are licensed to ship lily bulbs under provisions of The Agriculture Act 1930.

T. O. Covel
Henry & Lee
Malcolm Hollis
W. G. Hollis
M. J. King
E. W. Outerbridge Co.
J. R. Outerbridge
H. E. D. Smith
R. T. Smith

LICENSED SEEDSMEN.

The following persons or firms are licensed to sell Vegetable Seed under provisions of the Agriculture Act 1930 and Byelaws for the Sale of Vegetable Seed.

Henry Dunkley & Co
The Hill Co.
Meyer & Fox
J. R. Outerbridge
Hodgson Stores
O. R. Loblein Ltd.